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UNITED STATES NATIONAL MUSEUM
BULLETIN 188

THE FRESH-WATER FISHES OF SIAM, OR THAILAND

BY

HUGH M. SMITH

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The present work forms No. 188 of the *Bulletin* series.

Alexander Wetmore,
Secretary, Smithsonian Institution.

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THE FRESH-WATER FISHES OF SIAM, OR THAILAND[1]

By Hugh M. Smith[2]

INTRODUCTION

PURPOSE AND SCOPE OF THE CATALOG

The main purpose of this work is to make known, by means of a comprehensive and not too technical account, the nature, extent, and richness of the fish fauna inhabiting the fresh waters of the ancient Kingdom of Siam; to describe the relationships of the various groups; and to indicate what further collecting of specimens is necessary or likely to prove profitable scientifically. It is the intention to take cognizance herein of every species of fresh-water fish known from or ascribed to Thailand. In cases of reasonable doubt as to the validity of species described from the country or as to the accuracy of local records or citations, it has been thought proper to admit them to the catalog and trust to future observations to establish the facts.

If one accepts the definition that a fresh-water fish lives entirely in fresh water in both the young and the adult stages, and never descends to the sea (Hora, 1937a), it necessarily follows that according to its title this catalog cannot strictly cover those fishes that (1) normally inhabit brackish, estuarine, or river waters and may sometimes stray therefrom into fresh water, (2) pass most of their life in the sea and enter fresh water only at certain seasons for spawning or other purposes, and (3) occur indifferently in fresh or salt water. However, in order that this work may be more generally useful it will be made to include all species that may be found at any time in fresh water.

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[1] In view of the invariable use of the name Siam in previous ichthyological literature of the country, it is inevitable that this designation occurs frequently in the present catalog, which is based on investigations made and publications issued before the name Thailand was officially adopted in 1939. It should be understood that all references to Siam in the text, in the cited literature, and in the specific names of fishes apply to Thailand.

[2] Dr. Hugh McCormick Smith, formerly United States Commissioner of Fisheries (1913–1922), Adviser in Fisheries to the Siamese Government (1923–1935), and after 1922 Associate Curator in Zoology in the United States National Museum, died on September 28, 1941. Although work on this monograph of Siamese fresh-water fishes had occupied all his time at the National Museum since 1935, Dr. Smith did not quite complete the manuscript before his death. The final work necessary to put it in shape for editing and publication, such as the arrangement of families and the selection and supervision of all the drawings by Mrs. Alice C. Mullen and Mrs. Aime M. Awl, was done by Dr. Leonard P. Schultz, curator of fishes, United States National Museum. When in the course of this revision, type numbers were required and paratype numbers were found, Dr. Schultz added such numbers to the manuscript. Miss Gladys O. Visel and Dr. Schultz have added all the references for genera and the original references for species, since these were not included in Dr. Smith's manuscript. The gazetteer of Thai localities (p. 16) was prepared expressly for this catalog by Herbert G. Deignan, associate curator of birds, United States National Museum. For accounts of Dr. Smith's life and accomplishments in the fields of ichthyology and fisheries, see Copeia, Nov. 21, 1941, and the Journal of the Washington Academy of Sciences, Dec. 15, 1941.—Editor.

The scope of the title will be further broadened to include the gobies and catfishes; all local species will be considered whether or not they may be strictly fresh-water denizens, as, for several reasons, it has been thought desirable to present these families as a whole.

The publication of this catalog by no means implies that the subject is exhausted or that there is no need for future investigation. On the contrary, it is hoped that the present publication may serve as a stimulus to further study, which will throw much needed light on the bionomics of the known species and bring to notice many forms that as yet are unnamed. The vastness of the fresh waters of the plains areas and the remoteness and isolation of the innumerable mountain streams guarantee that for many years to come important work may be profitably undertaken by governmental agencies and by individuals. Further collecting is especially desirable in the streams of the western side of Peninsular Thailand, in streams contiguous to the Malay States, in the Menam Mun and its tributaries in Eastern Thailand, in mountain streams of the eastern slope of the Peninsula, and in streams of the western frontier east of Moulmein.

The classification, the arrangement of families and genera, and the terminology herein followed are in general in conformity with "The Fishes of the Indo-Australian Archipelago," by Max Weber and L. F. de Beaufort (vols. 1 to 8, 1911 to 1940), with such modifications as appear to be warranted or demanded by the more recent taxonomic studies and conclusions of various ichthyologists. Full descriptions of families, genera, and species have in general been omitted because they are available in the Literature Cited and would unnecessarily swell the bulk of the catalog. The artificial keys are believed to be sufficiently full and explicit to enable qualified persons to allocate and identify any species that may come to hand in field, laboratory, or museum. The keys should, of course, be used with proper discrimination and with due allowance for variations dependent on size, age, sex, breeding condition, and individual departure from the normal.

The synonymy includes practically every published citation of a Thai species or locality. The form of the citations has been abbreviated from the full references given in the Literature Cited. The synonymy has been restricted to citations pertaining to Thailand, except in a few special cases in which there may be reasons for giving references to nearby countries.

In the numerous citations of Bleeker's records for Siamese fishes, the figure appearing in parentheses after the year of publication is the arbitrary running number assigned by Weber and de Beaufort in the list of Bleeker's papers as given in volume 1 of "The Fishes of the Indo-Australian Archipelago" (1911).

For most species a statement is made of its general range, its local distribution, its size, its spawning and other habits as far as known, and its food value and economic importance. For many genera and species discussions of taxonomic relations, nomenclature, local variations, and color notes on living specimens are included. To render the catalog more generally useful to laymen and to facilitate the identification of specimens in markets and in the catch of fishermen, many of the local vernacular names are given.

The catalog includes 15 orders, 49 families, 9 subfamilies, 209 genera, of which 8 are new and 1 has been given a new name, 560 species, including 50 new to science and 1 new name, and 5 subspecies. One new subneus (p. 97) is proposed.

SOURCES OF INFORMATION

The principal basis for this work is the collections and observations made in Siam by the writer in the years 1923–34, during which he was adviser in fisheries to the Siamese Government. All sections of the country were visited, large collections were preserved, and information was obtained by personal observations and by interviews with local officials and fishermen. These collections were supplemented by specimens brought in by various assistants in the Siamese Bureau of Fisheries.

Other material from government sources consisted of valuable specimens from Eastern and Northern Siam obtained by employes of the Royal Forest Department, and a miscellaneous lot of fishes, badly preserved and poorly labeled, which had been accumulating for many years in the Royal Siamese Museum, an institution that as a depository of zoological objects has now ceased to function.

A representative series of specimens was presented to the United States National Museum by the Siamese Bureau of Fisheries, which also lent certain other material for examination in Washington.

Numerous specimens of fresh-water fishes from all parts of the country obtained by Layang Gaddi during his general zoological collecting for the United States National Museum have been recorded in the present work.

One of the most extensive collections of Siamese fresh-water fishes was made about 1921–22 by Dr. Malcolm A. Smith, at the time living in Bangkok, now with the British Museum. His specimens were mostly from Bangkok and the lower Menam Chao Phya, but some came from streamsi n the mountains of Nakon Sritamarat in Peninsular Siam and on Koh Chang in the Gulf of Siam. Most of his material was sent to Calcutta and was there studied and reported on by Dr. Sunder Lal Hora, of the Indian Museum; some of the specimens, retained in Siam, reached the Siamese Bureau of Fisheries and were examined by the present writer.

The British Museum is an important depository for Thai fishes, obtained by donation, purchase, or otherwise over a long period of time. Through the courtesy of the museum authorities, the writer was able to examine all desired material and to make comparison with specimens taken to London for this purpose. The major earlier collections of Siamese fishes in that museum are (1) the Mouhot collection, obtained by purchase in 1859, registered in 1861; (2) the Jamrach collection, purchased, registered in 1862; (3) the Schomburgk collection, made by Sir Robert Schomburgk, British consul at Bangkok, registered in 1865; (4) the Peters collection, received from Prof. W. C. H. Peters in 1868; (5) the Siamese Museum collection, presented by the museum, registered in 1897; (6) the Flower collection, made by Capt. Stanley S. Flower, registered in 1898; and (7) the Chumporn collection, presented by H. R. H. Prince Chumporn, Siamese minister to England. Of special interest is the small lot of fishes obtained by Henri Mouhot in his pioneer travels in 1858–60, including the types of new species described by Günther. British travelers, explorers, and residents in Siam contributed numerous specimens in recent years.

Of great interest and value have been the fish collections made for the United States National Museum by H. G. Deignan during the years 1935–37. All his material came from fresh water, much of it from localities in Northern Thailand from which no fish specimens had previously been taken. Mr. Deignan's collections, comprising many forms, have been studied in Washington and are reported on herein. A valuable part of the Deignan collections was obtained by A. R. Buchanan and P. D. Harrisson of Chiengmai, from the Mechem, a tributary of the Meping, and various affluents, from which no previous fish specimens had been received.

The Museum of Comparative Zoology has courteously made available for study and report a collection of fishes obtained in 1937 at Chiengmai and on Doi Angka, Northern Thailand, by the Harvard Primate Expedition, Harold J. Coolidge, Jr., director. This collection, though small and from waters where fishes had been obtained by others, was of considerable interest and contained representatives of species regarded as new. The information afforded by a study of this collection has been incorporated in the present catalog and a set of duplicates was presented to the United States National Museum.

In addition to the knowledge of Siamese fishes obtained by observation in the field, in local aquaria, and in markets, and by the study of various collections, all published articles on the subject have been consulted and the information therein has been fully utilized in preparing the present work. The ichthyological literature of Thailand is referred to in the section following. Among the ichthyologists of a former period to whom the writer feels especially indebted because of their indispensable works are Pieter Bleeker, Albert Günther, and Henri Émile Sauvage.

ICHTHYOLOGICAL LITERATURE OF THAILAND

A considerable literature pertaining to Siamese fishes has been accumulating for more than 80 years. Some of the published articles have dealt with single species, genera, or families; some have had only incidental references to local forms in general reviews or studies of families; others have dealt with the fishes of particular waters; and some have been based on more or less extensive collections in various districts of the country.

The first references to Siamese fresh-water fishes in ichthyological publications seem to have been in papers by Pieter Bleeker (1819–1878), with the exception of a single species (*Ophicephalus serpentinus*) described from Siam in 1831 by Cuvier and Valenciennes.

It was to have been expected that Bleeker, who specialized in Oriental fishes and, according to Dr. Theodore Gill, was "the most active ichthyologist that ever lived," should have been interested in the fish fauna of Siam and should have made noteworthy contributions thereon. It does not appear that Bleeker ever visited Siam, but he had opportunity to examine and report on collections made by others. He published seven papers dealing wholly with Siamese fishes between 1860 and 1865, as well as several others in which Siamese fishes were mentioned or figured. Several papers, in identical form, appeared more or less simultaneously in two different scientific journals. His monumental "Atlas Ichthyologique des Indes Orientales Néerlandaises" (9 vols., folio, 1862–1877) contains various references to the occurrence of East Indian fishes in Siam, and is indispensable to students of fishes of the Oriental region. The first of the Siamese papers (1859–60 [239]) identified species represented in an album of drawings said to have been made by Count Castelnau in Siam. In 1865 Bleeker (347) gave a list of 89 species of fishes examined by him in the Musée du Jardin des Plantes à Paris, which had been collected in the Menam Chao Phya by Dr. Bocourt. Twelve species noted as new were not described at the time ("restent à decrire") but were subsequently described by Bleeker in various publications with the exception of three catfishes, which were named in a publication by Bocourt. In 1865

Bleeker (356) listed all the species of fishes actually known from Siam, 177 in number, including marine forms.

Among the noteworthy Siamese fresh-water fishes described as new by Bleeker are the catfish *Heterobagrus bocourti*, the loach *Botia modesta*, and the cyprinids *Puntius proctozysron* and *Paralaubuca typus*.

A valuable early account of Siamese fishes appeared in 1866 under the authorship of Firmin Bocourt in "Notes sur les reptiles, les batraciens et les poissons recueillis pendant un voyage dans le royaume de Siam," which formed a part of the general work by A. Milne-Edwards on the expedition of Bocourt to Siam. It was in this article that Bocourt described and figured the catfishes *Pangasius larnaudii* and *Micronema bleekeri*, now *Kryptopterus bleekeri* Günther, and that Bleeker was credited with *Heterobagrus bocourti*.

Beginning in 1878 and continuing till 1883, H. E. Sauvage, of the Paris Muséum d'Histoire Naturelle, published a series of important articles on the fresh-water fishes of Indo-China and of Siam, based chiefly on collections made by Jullien and Harmand. A number of new forms inhabiting Siam were described and figured, including four catfishes (*Hemipimelodus siamensis*, *Pangasius pleurotaenius*, *Helicophagus hypophthalmus*, and *Pseudeutropius siamensis* [now *Platytropius siamensis*]) and various cyprinids (among them *Barilius ornatus*, *Cirrhinus microlepis*, *Cosmochilus harmandi*, *Probarbus jullieni*, and *Puntius siamensis*). Of special interest and importance is the paper "Sur une collection de poissons recueillie dans le Mé-Nam (Siam) par M. Harmand" (1883b), listing 70 species, some new, some recorded from Siam for the first time. It is in this paper by Sauvage that there occurs one of the most curious lapses in the whole history of ichthyology. A catfish, *Pseudobagrus nudiceps*, is described as new. In the same publication and on immediately preceding pages, Sauvage (1883a) had a paper entitled "Sur une collection de poissons recueillie dans le lac Biwako, (Japon) par M. F. Steenackers," in which, in language practically identical with that used in the Siamese paper, he described as new, obviously from the same specimen or specimens, a catfish under the name *Pseudobagrus nudiceps*. This species certainly does not exist in Siam, and the genus has no known representative south of China.

Under the auspices of the University of Edinburgh and the University of Liverpool, Nelson Annandale and Herbert C. Robinson made an expedition to Perak and the Siamese Malay States in 1901–2, the results of which were published under the title "Fasciculi Malayenses." In part 2 of the section devoted to zoology, James Johnstone contributed a "Report on the Marine Fishes" containing a description of one supposed new goby (*Periophthalmus phya*) from the estuaries of the

Jambu and Patani Rivers; and G. A. Boulenger supplied a mere "List of Freshwater Fishes," 12 in number, all of which except one were taken in the Patani watershed, and most of them from the Patani River between Biserat and the town of Patani.

Among other authorities who have contributed to the knowledge of Siamese fishes are: Albert Günther, of the British Museum, whose "Catalogue of the Fishes" in that institution (1859–1870) contains descriptions of a number of new forms from Siam (including the archerfish *Toxotes microlepis*, the serpenthead *Ophicephalus siamensis*, and the sole *Cynoglossus xiphoideus*), mostly collected by Henri Mouhot and described also in an appendix to Mouhot's posthumous volumes; George A. Boulenger, of the British Museum, who, in a paper entitled "Description of a New Genus of Cyprinoid Fishes from Siam" (1898), gave an account of the remarkable *Catlocarpio siamensis* and made incidental references to local species in other papers; L. S. Berg, who in 1906 described *Gyrinocheilus kaznakovi* from a part of Siam now in Cambodia; C. Tate Regan, of the British Museum, who, in his "Asiatic Fishes of the Family Anabantidae" (1910), described two important Siamese species, the fightingfish *Betta splendens* and the anabantid *Trichopodus pectoralis*, now *Trichogaster pectoralis*, and in another paper (1913) described the catfish *Leiocassis siamensis;* Hialmar Rendahl (1920) who made known a new cyprinid *Barbus bantamensis*, now *Acrossocheilus bantamensis*, from Northern Siam; J. R. Norman, of the British Museum, who in 1925 described a new cyprinid *Barbus vernayi*, now *Puntius vernayi*, collected by Arthur S. Vernay in the Mewong, north-central Siam; W. C. H. Peters (1868), who listed 17 species of Siamese fresh-water fishes collected in January to May 1861 by Dr. F. Jagor; Eduard von Martens, who (1865–1876) reported on the fishes collected on the Prussian Expedition to Eastern Asia (1860–1863) and listed about 45 species of Siamese fresh-water fishes obtained at Bangkok and Petchaburi; Franz Steindachner, who in 1879 described the cyprinid *Luciosoma bleekeri* and the catfish *Pangasius siamensis* from the Menam Chao Phya at Bangkok; Ernst Ahl, whose "Eine Revision der Cypriniden-Gattung Esomus" (1924) contains a description of *Esomus metallicus* from Siam; Erna Mohr (1926a), who described two new hemiramphs, *Zenarchopterus clarus* and *Z. pappenheimi*, from Bangkok; L. F. de Beaufort, who, in 1927, published a description of a new cyprinid *Tylognathus siamensis;* George S. Myers, who in two papers (1928 and 1937) extended our knowledge of the remarkable family Phallostethidae, describing *Phenacostethus smithi* and *Neostethus siamensis* as new; and A. S. Pearse, who, in 1933, in a paper entitled "The Gobies at Paknam," gave an interesting account of the food and parasites of certain species of gobies abounding in the lower Menam Chao Phya.

Among other recent publications on Siamese ichthyology, special mention should be made of two by Sunder Lal Hora, one appearing under the title "On a Collection of Fish from Siam" (1923b), the other entitled "Fish of the Tale Sap, Peninsular Siam" (1924a). In the former paper, based entirely on collections made by Dr. Malcom Smith mostly in the Menam Chao Phya near Bangkok, there were described as new *Culter siamensis*, *Barbus smithi* (described from Siam many years earlier by Bleeker under the name *Puntius proctozysron*), *Glyptothorax siamensis*, and *Mastacembelus armatus* var. *favus*. In the latter paper, based on collections made by Dr. N. Annandale, new forms described were the fresh-water pipefish *Michophis annandalei* and the spiny-eel *Mastacembelus circumcinctus*, together with several brackish-water or marine species. Dr. Hora has published also valuable incidental references to or accounts of Siamese fishes in his papers on the fishes of India and Burma, and in 1937 (c) he described a new genus (*Platytropius*) of Siamese schilbeid catfishes to accommodate Sauvage's *Pseudeutropius siamensis*.

A small collection of fishes mostly from Peninsular Siam, made by Dr. H. Bernatzik in 1936 and 1937, was reported on by Dr. F. P. Koumans (1937a). The collection, in the Natural History Museum in Basle, Switzerland, contains examples of 37 species, of which one, *Barilius bernatziki*, from a mountain stream between Trang and Patalung, is described as new and is interesting as being the only species of *Barilius* reported from Peninsular Siam, although another species (*B. guttatus*) is known from Pahang, one of the Federated Malay States. This new species, together with a number of other forms, is stated to have been taken at "Kapa, N. W. Peninsular Siam." There does not appear to be any locality properly so called, and it is believed that the place intended to be mentioned is Takuapa, a small community on the west coast of Peninsular Siam north of Puket. Another locality erroneously indicated from which fish specimens were obtained is "Lake of Patalung, N. W. Siam." This is obviously intended for the inner lake of the Tale Sap, Peninsular Siam; near its head is the Patalung River, with the town of Patalung several miles above its mouth.

Of special importance among the most recent publications on Siamese fishes has been a series of six articles by Henry W. Fowler based on collections made by or for R. M. de Schauensee between 1932 and 1936. The articles, appearing in the Proceedings of the Academy of Natural Sciences of Philadelphia, have contained descriptions of many new genera and new species; and all new forms, as well as many previously known, have been illustrated from original drawings by Fowler. As much of de Schauensee's material came from interior waters, the reports thereon have special value in connection with the present catalog, and detailed consideration thereof has been given herein in the systematic treatment. It may be pointed out that localities in which specimens were collected, as noted in Fowler's papers, cannot always be accepted as correct for the reason that many of the specimens came from city markets. For Bangkok, especially, the locality thus given means very little, for sea fishes from all parts of the northern, eastern, and western coasts of the Gulf of Siam reach Bangkok by rail and vessel, as do fresh-water fishes from the Meklong, the Tachin, and the Bangpakong, as well as from the Menam Chao Phya and its numerous branches and connecting canals. It should therefore be understood that marine and brackish-water species attributed to Bangkok or other interior communities may not have come from local Bangkok waters.

An important recent paper is "A Contribution to the Ichthyology of the Malay Peninsula" by Albert W. C. T. Herre and George S. Myers (1937), for while it pertains little or not at all to the fishes in the Siamese part of the Malay Peninsula, it indicates the presence in the Malay States of a number of species previously known only from Siam and suggests the existence in Siamese territory of various Malayan species that may be discovered when further collecting is done in the southern provinces.

Special mention should be made of the fact that several papers on Siamese fresh-water fishes have had Siamese authors. The first of these, "Notes on Rod Fishing in Bangkok," by His Serene Highness Prince Vipulya (1923), embodies interesting notes on the game fishes of the Menam Chao Phya in the vicinity of Bangkok, with scientific identification of the species as well as their vernacular names. Noteworthy as being the first systematic paper by Siamese is "Note on Some Freshwater Fishes of Koh Samui and Koh Pa-ngan, Gulf of Siam" (1932), by Luang Masya Chitrakarn and Boon Chuay Indrambarya, of the Siamese Bureau of Fisheries. Some original observations on the breeding, growth, food, habits, etc., of an outstanding local species, the fightingfish (*Betta splendens*), are given in a paper (1930) by Choola Jedadib, of the Siamese Bureau of Fisheries.

The most noteworthy of the ichthyological publications by Siamese authors is "Index to Fishes of Siam" (1936), by Chote Suvatti, of the Siamese Bureau of Fisheries. The work, in part a citation from published records and in part a list of localities represented by specimens in the local government collection, is based largely on a fully annotated card catalog of Siamese fishes inaugurated and maintained by the present writer during his sojourn in the country. The treatment comprises the recording for each species of the scientific name, the Siamese vernacular names (in Siamese characters), literary citations for Siam (in Roman characters), and the localities (in both Siamese and English) from which the species had been recorded in the catalog.

The "Index," which is thus more than an index, serves the useful purpose of giving a general list of the known species of Siamese fishes.

During 12 years spent in Siam, the present writer published numerous articles on the local fishes. These for the most part appeared in the Natural History Supplement of the Journal of the Siam Society, and one paper was contained in the Proceedings of the United States National Museum under the title "Descriptions of New Genera and Species of Siamese Fishes" (1931a), most of the species referred to being from fresh water. Three articles on Siamese fresh-water fishes of special popular interest—the walkingfish, the archerfish, and the fightingfish—appeared in 1936 (a, b) and 1937 (b) in Natural History, the magazine of the American Museum of Natural History. Various other papers, all listed in the accompanying literature cited and dealing for the most part with matters of nomenclature, have been published in Copeia, Proceedings of the Biological Society of Washington, Journal of the Washington Academy of Sciences, The Aquarium, and elsewhere.

ORIGIN AND RELATIONSHIPS OF THE FRESH-WATER FISH FAUNA

In his earliest papers dealing with the fishes of Siam, Bleeker (1859-60 [239]) noted the strong resemblance existing between the fish fauna of the Menam, the large river of Bangkok, and that of the rivers of Borneo and Sumatra. He commented on the subject in a later paper, about 1865, and noted not less than 35 species common to Siam and to islands now separated from the mainland of Asia by wide and deep stretches of salt water. Bleeker does not appear to have attempted an explanation of this outstanding phenomenon.

In a paper entitled "The Continental Shelf of French Indo-China and the Relationship Which Formerly Existed between Indo-China and the East Indies," Krempf and Chevey (1934), of the Oceanographic Institute of Indo-China, announced the results of oceanographic investigations and made deductions therefrom that bear on the present similarity of the fish fauna of the East Indies and southeastern Asia. What was said of French Indo-China applies equally well to Siam. They noted the work of Dutch investigators in studying the continental plateau of Java and the Sunda Islands with reference to its geological history and in tracing the course of river valleys now submerged. In the southern part of the China Sea there has been outlined a vast estuary of a great river that drained northern Borneo and Sumatra and the eastern slopes of the Malay Peninsula; the bed of this river, called the North Sunda River, is now under 40 to 100 meters of water. Krempf and Chevey described the bed of a similar vast river, called the Great South Indo-China River, which flowed from northwest to southeast and emptied about 150 miles north of the North

Sunda River, its bank being at the level of the present 100-meter isobath. Between these two great rivers was an extensive plain from which rose a few isolated mountains less than 200 meters in height. The writers pointed out:

> It will be quite apparent that interchanges of freshwater fauna between the two hydrographic systems would be very easy or rather that there was only one and the same fauna common to all this immense region. * * *
>
> The practical identity of ichthyologic fauna in countries now separated by the sea, is easily understood when the geologic history of the area is known. Recreation in thought of the great continental block joining these countries as it appeared before its immersion, with its two great rivers, provides at once the key to the common origin of the fauna.

In a table showing "distribution of the freshwater fishes of southern Asia," Krempf and Chevey listed species of the East Indies, Indo-China, Burma, and India but made no mention of Siam and Malaya, which, inferentially, are included under Indo-China; certain species are shown thereunder that are known only from Siam. The table, while fully illustrating the great similarity between the fishes of Indo-China and the East Indies, loses some of its force by incompleteness and errors. Only 76 species of fishes common to Indo-China (and Siam) and the East Indies are shown. The list could be doubled, and about 40 cyprinoid species alone are omitted. Among the errors are the inclusion under the East Indies of genera and species peculiar to Siam and Indo-China (e. g., the cyprinoid *Puntioplites proctozysron*), the omission from the East Indian list of common species found there as well as Indo-China (e. g., the catfish *Wallago dinema*), and the nonlisting of various species of Indo-China (and Siam) that are known also from Burma and India (e. g., the catfish *Clarias batrachus*).

In the foregoing conception, the fresh-water fish fauna of the East Indies, Indo-China, Malay Peninsula, and Siam had a common origin. The general subject is discussed at some length by Hora (1937a) with special reference to India; but inasmuch as his observations and conclusions have a more or less direct application to Siam, they are quoted directly:

> The relationships and the geographical distribution of the freshwater fishes of India were discussed by two of the leading ichthyologists, Day and Günther, of the last century. The former advocated Malayan affinities for the Indian fauna, while the latter, though admitting the migration of several Oriental freshwater fishes to Africa, laid special stress on the African affinities of this fauna. Beyond some casual references very little work has since been done on this aspect of the Indian freshwater fishes, and in view of the advances that have been made in our knowledge of the paleogeography and systematics of fishes it seems opportune to review the whole subject in the light of recently discovered facts.
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> There is an unfortunate impression, mainly among geologists, that in the case of fishes dispersal may be effected through the agency of birds, chiefly

> aquatic species, which may carry the eggs attached to their feet from one watershed to another. Those who have paid particular attention to this matter, however, are definitely of the opinion that such a mode of dispersal of freshwater fishes is normally highly improbable, even though there may be records of such fortuitous dispersal in practically all groups of animals including freshwater fishes.
>
> In connection with my work on the Siluroid fishes of India for a revised edition of "Fishes" in the *Fauna of British India* series, I have been greatly struck by the close similarity of the Indian forms to those found towards the east in Indo-China, Siam, and the Malay Archipelago. As a result of a detailed study of the genera and species inhabiting these regions I am definitely of the opinion that the freshwater fish fauna of India in the main originated in South-eastern Asia, most probably in Indo-China, and spread westwards by successive waves of migration to India and later to Africa while the two masses of land were connected with each other. Gregory's researches on the evolution of the mountain and river systems of South-eastern Asia have shown that in this region there were extensive river captures—the rivers on the west beheading the rivers on the east; these changes made possible the migrations of aquatic animals from the east to the west but not in the reverse direction. Gregory's researches have further shown that all the rivers of Eastern Tibet drained into the Gulf of Siam or the South China Sea before the present river systems became established. * * * The freshwater fauna of Eastern Asia at least may have originated along the coasts of Indo-China, when the ocean water in this area was greatly diluted by the drainage into it of several river systems.
>
> Professor Gregory's views about the capture of the eastern rivers by the western rivers are, however, not accepted by all geologists; * * * but a considerable mass of evidence bearing on the close relationship and distribution of the fishes of South-eastern Asia demands for its explanation a hypothesis similar to that worked out by Gregory.

Inasmuch as Thailand is geographically separated from parts of Indo-China, Burma, and Malaya by only political barriers, with large rivers constituting international boundaries, it is natural that there should be many species of fresh-water fishes common to Siam and the adjoining countries. With every new activity in the making of fish collections in waters at or near the boundaries, the number of overlapping species becomes augmented, and some additions to the known common faunas of these contiguous countries may be expected from time to time for many years.

That part of the Malay Peninsula that lies in Thailand is essentially similar physically to the remaining part constituting the Federated and Non-federated Malay States. The boundary is artificial, and the fish life on the two sides should, and does, present few differences, and those differences will become less striking and may largely disappear as the result of further observations and collecting. The recent work of Herre and Myers (1937) has disclosed for Malaya a very large number of species known also from Siam.

In the forest-covered mountains of Northern Siam streams tributary to the Mekong, the Menam Chao Phya, and the Salwin basins may have fishes that specifically are common to two or all three of these drainage systems. While the present watersheds would not permit the passage of fishes from one to another, it is apparent that at no very distant geological period physical barriers were not insurmountable and that fish populations now cut off from one another had the opportunity to mingle.

While Thailand has a very large percentage of species identical with forms known also from Sumatra, Borneo, Java, and other East Indian islands, there is a considerable number of striking Siamese genera of both the plains rivers and the mountain streams that are wholly unrepresented in the Indo-Australian Archipelago. Among these are the cyprinoid genera *Aspidoparia*, *Barilius*, *Catlocarpio*, *Cirrhinus*, *Oreichthys*, *Probarbus*, *Puntioplites*, *Scaphiodonichthys*, *Scaphognathops*, and *Xenocheilichthys* and the siluroid genera *Amblyceps*. *Heterobagrus*, and *Oreoglanis*.

ZOOGEOGRAPHIC DIVISIONS OF THAILAND AND THEIR PRINCIPAL FRESH WATERS

C. Boden Kloss (1915) proposed for Siam certain divisions in order to afford to naturalists and others a better understanding of the zoology and to avoid confusion in the recording of information. The divisions suggested—Northern, Central, Western, Peninsular, Eastern, and Southeastern Siam—may be convenient in the consideration of the distribution of land animals but they are not always applicable to fishes, for which the logical division of the country would be into river basins or drainage systems. It happens, however, that the Central, Peninsular, Eastern, and Southeastern divisions proposed by Kloss may in general be accepted for fishes, leaving the limitations of Northern and Western Siam subject to modification.

Northern Siam has been defined as all that part of the country lying north of latitude 17°50′. It is mostly mountainous and forested and is drained by three great rivers, the Salwin or Menam Kong, the Menam Chao Phya (through its tributaries the Meping and the Menan), and the Mekong.

The northwestern corner of Northern Thailand is drained mostly by the Menam Pai, which enters the Salwin soon after receiving the Menam Surin as its chief affluent. Farther south another tributary of the Salwin, the Menam Mue or Thaungyin, has as its principal affluent the Menam Yuam, an important stream with a generally southern course. The Salwin and the Menam Mue constitute the Thailand–Burmese boundary for upward of 300 kilometers. The part of Siam drained by the Menam Mue may properly be treated as Northern Siam, although classed as Western Siam by Kloss, who defined this division as including all that area lying between the mouth of the Menam Mue on the north and Koh Lak on the south and between the Tenasserim border and the Gulf of Siam, taking in a part of the central plain as drained by the Petchaburi and Pran Rivers. Western Thailand, if it is necessary to recognize this division, might more properly and conveniently be regarded as the mountainous region between Northern Siam and Peninsular Siam extending along the Thailand–Burmese frontier and involving the headwaters of the Meklong, Petchaburi, and Pran Rivers.

Of the major affluents of the Menam Chao Phya in Northern Thailand the Meping is the most western, rising in the Den Lao Range and having among its tributaries the Mechom, the Mechem, the Mewang, and the Meklang, the last-named stream draining Doi Angka, the highest mountain in the country. The Meyom, and the Menan rising in the Pi Pan Nam Mountains, drain a large part of the eastern section of Northern Siam.

Entering the Mekong along its short course where it forms part of the boundary between Thailand and French Laos, there are two noteworthy streams, the Meing and the Mekok, which taking rise respectively in the Pi Pan Nam Mountains and in the Khun Tan and Den Lao Ranges, drain wide, level, sometimes swampy districts before entering the great parent river. The Mekok has as a principal tributary the Mefang, which in turn has the Memao as one of its branches.

Central Thailand is the comprehensive designation for the vast plain watered by the Menam Chao Phya and its tributaries and collaterals, by the lower Meklong, by the lower Petchaburi and Pran, and by the Bangpakong and its affluents the Nakon, Nayok, the Sakeo, and the Prachin. Flowing into the Menam Chao Phya at its head at Paknampo and constituting its chief sources are the Meping and the Menan, the latter joined near its mouth by the Meyom. Discharging into the Menam near its mouth is the celebrated Bung Borapet, which has been converted into a permanent lake by the construction of barriers and has been set aside by the government as a fish nursery and sanctuary. Coming into the Menam Chao Phya from the northwest is a stream known as the Mewong, which rises in the Tanon Tong Chai Range and is the principal western tributary of the Chao Phya. Lower down, about 50 kilometers south of Paknampo and 200 kilometers from the Gulf of Siam, the Chao Phya splits into a number of large streams and forms a delta. The main river divides and reunites, its principal divisions being the Menam Yai, Menam Noi, and Menam Lopburi, which coming together in the region of Ayuthia and joined by a great eastern tributary, the Menam Pasak, flow past Bangkok and enter the Gulf of Siam as a mighty stream whose freshness and silt and mud are carried far into the sea. The other main part of the Chao Phya, beginning as the Menam Supan and changing into the Menam Nakon Chaisi, becomes the Menam Tachin and enters the Gulf of Siam about 40 kilometers west of the Chao Phya.

The Menam Chao Phya is the outstanding physical feature of the country and it is to Thailand what the Nile is to Egypt and the Mississippi is to the central part of the United States. With its tributaries and the other streams with which it is connected by canals, it is the main channel of communication and provides the means of transportation for two of the great products, teak logs in rafts and rice in barges. It is furthermore a perennial source of invaluable fertilizer, which, in the form of silt, is brought down by the annual floods and deposited on the inundated ricelands.

This is the region of greatest abundance and variety of fish life, which, in consequence of the vast watery areas resulting from the annual inundations, is afforded boundless opportunity for reproduction and growth. Connected with the teeming streams are extensive marshes and swamps, which are annually converted into lakes, to which the fishes resort for spawning purposes; with the subsidence of the flood waters and steady evaporation during the long period of drought, the lakes shrink and many of them revert to marshes and swamps before another flood season comes.

Peninsular Thailand, formerly sometimes referred to as Lower Siam or Southern Siam, may be considered as extending from Koh Lak to British Malaya, with a frontage on the Gulf of Siam and the Indian Ocean except where, on the west, it is bordered by the Tenasserim Range and the Menam Kra. The topography is varied, consisting of coastal flats, plains, and forest-clad mountains, with numerous small streams and several of some magnitude. The Menam Bandon, a short tidal water, is entered by the Tapi and the Kirirat, which are fair-sized rivers flowing northward and draining rather extensive mountain and plain areas. Farther south, occupying an extensive plain on the east side of the peninsula, is the large Tale Sap, or Inland Sea. This consists of an inner lake that is fresh and an outer lake that is brackish and discharges into the Gulf of Siam at Singora. The Tale Sap, with its much smaller Tale Noi connected with its northern arm, provides conditions very favorable for fish life. At the southeastern corner of Peninsular Thailand the Patani Plain is drained by the Menam Patani and the Menam Saiburi, which rise in the mountain range forming the Malayan boundary; while on the west side the only noteworthy stream is the Menam Trang.

Eastern Thailand, much the largest of the natural geographical divisions, consists principally of a saucer-shaped plateau, which is flooded during the wet season and suffers from a scarcity of water during the dry season. The Mekong forms the northern and eastern boundaries; on the west the Pechabun Mountains and Dong Phya Yen Range separate it from the central plain; and on the south the Dong Pek Scarp divides it from Cambodia. Drainage is principally by the Menam Mun, a very sizable stream that enters the Mekong from the west and has as its main tributary the Menam Chi, which supplies a large part of the plateau. The discharge from two shallow but extensive lakes in the north is effected by the Menam Pau, a tributary of the Menam Chi. In the eastern part of the plateau is Lake Lahan, having an area of about 170 square kilometers, the largest fresh-water lake in the country, which is both flooded and drained by the Nam Kam. The only other noteworthy stream is the Menam Songkram, which enters the Mekong from the northeast section of the division. When the Mekong is in flood there is a strong reverse current in all the tributary streams.

Southeastern Thailand is a small division lying south of the Bangpakong and bounded on the east by the Bantad Range forming a part of the Cambodian border and on the west by the Gulf of Siam. It has a varied topography, with a detached mountain range (Chantabun Mountains), forested plain, extensive tidal areas covered with marsh grass and mangrove swamps, short rivers of which the principal are the Chantabun, the Wain, and the Trad or Krat, and numerous rocky jungle-clad fringing islands. The largest island, Koh Chang, is 30 kilometers long with an area of 180 kilometers. It is forest-clad and very rugged, with the highest of the peaks 644 meters, and in clear, cool rocky streams below picturesque waterfalls there is an interesting fish life.

GAZETTEER OF COLLECTING LOCALITIES IN THAILAND

In the Thai language generic prefixes are commonly applied to geographical names (i. e., *ao*, gulf, bay, bight; *ban*, village). In this gazetteer the generic prefixes are given in parentheses following the name [cf. Kong (Mae Nam) for Mae (Nam) Khong; in the text of the catalog the name used would be Mekong]. This has been done for the sake of consistency even where foreign usage treats the prefix as an inherent part of the name. Such names as Ban Mæ Sot ("Village of the River Sot") and Doi Mæ Kong Ka ("mountain of the River Kong Ka") are listed as Mæ Sot (Ban) and Mæ Kong Ka (Doi).

In every case the spelling of the name *proper* used in the text has been placed first [i. e., Me*kong* (Kong being considered the name proper) would be listed as Kong (Me or Mæ, "river," generic prefix, understood)], instead of Khong. Whenever such transliteration disagrees with that used (since 1940) by the Royal Survey Department at Bangkok, the name is given also, as a subsidiary to the spelling used in the text, according to the more recent system. In certain instances a frequently employed (and sometimes mandatory) alternative name is listed as well (i. e., the dialectic spelling Nang Ka for the mountain correctly pronounced Langka and now officially named Pha Cho).

The generic prefixes here used (with variants in parentheses) are as follows:

Ao: Gulf, bay, bight.
Ban: Village.
Bung: Marsh.
Doi: Mountain (northern).
Huai (Huey), Huai Mæ, Huai Nam: Brook, stream.
Khao (Kao): Mountain (southern).
Khlong (Klong): Canal, stream.
Ko (Koh): Island.
Krung: Capital city.
Kwan: Lake (northern).
Lam: Brook, stream.
Lam Nam Tok: Waterfall stream.
Laem (Lem): Peninsula, cape.
Mæ (Me) Nam, Nam Mæ, Mæ Nam (Menam in the text): River, large or small.
Muang: Town.
Nong: Marsh.
Tambon (Tambol): Political subdivision of a *changwat* (province).
Thiu Khao: Mountain range.

Pronunciation of Thai names can be only approximately indicated by the Roman alphabet and no useful purpose would be served by mentioning more than that *æ* and *œ* should be considered diphthongs, the former having the value of *a* in English "hat," the latter sounding somewhat like the German *ö*.

Distances and directions have been derived from the Map of Siam (1: 2,000,000) issued by the Royal Survey Department at Bangkok, B. E. 2460.

Locality names used in the synonymy have been made consistent regardless of the spelling employed by the original author.

ABBREVIATIONS

C=Central Thailand.
N=North Thailand.
E=East Thailand.
W=West Thailand.
NW=Northwest Thailand.
SE=Southeast Thailand.
P=Peninsular Thailand.

LOCALITIES

Ang (Ban): Settlement at the base of Khao Sabap; SE.

Angka (Doi), **Ang Ka, Inthanon:** High mountain (over 8,000 feet) about 35 miles WSW. of Chiang Mai; N.

Angtong (Muang), **Ang Thong:** Town on the Chao Phaya about 15 miles NNW. of Ayutthaya; C.

Aw (Huai), **O:** Tiny brook of the Mæ Nam Nan system near Ban Khana; N.

Ayuthia (Krung), **Ayutthaya, Phra Nakhon Si Ayutthaya, Krung Kao:** Old capital on the Chao Phaya about 40 miles N. by E. of Bangkok; C.

Bajo (Lam Nam Tok), **Ba Cho:** Waterfall stream in the Province of Pattani; P.

Ban Po (Khlong), **Ban Pho:** Canal in the city of Bangkok; C.

Bang Tæng (Khlong): Stream tributary to the Mæ Nam Krat; SE.

Ban Yao (Mæ Nam): Short stream entering the Gulf of Siam about 24 miles SSE. of the Chanthaburi; SE.

Bandon (Ao), Ban Don: Bight of the Gulf of Siam on which the town of Ban Don is situated; P.

Bandon (Mæ Nam), Ban Don, Ta Pi: River on which the town of Ban Don is situated; name applied only to the lowest reach of the Ta Pi; P.

Bang Sorn (Ban), Bang Son: Suburb of Bangkok on the Chao Phaya above the city; C.

Bang Torani (Ban), Bang Thorani: Village on the Mæ Nam Chao Phaya between Bangkok and Ayutthaya; C.

Bangkam (Mæ Nam), Bang Kham: Stream tributary to the Mæ Nam Lopburi at Lopburi; C.

Bangkapi (Khlong), Bang Kapi: Canal in the city of Bangkok; C.

Bangkok, Bang Kok: Name commonly applied by foreigners to the capital of Thailand, from the village that anciently stood on the left bank of the Chao Phaya and formed the nucleus around which has grown the great city known to the Thai as Phra Nakhon or Krung Thep; C.

Bangpa-in (Ko), Bang Pa-in: Island in the Chao Phaya about 34 miles N. by E. of Bangkok; C.

Bangpakong (Mæ Nam), Bang Pakong: River entering the Inner Gulf of Siam at its northeastern corner; C.

Bangsai (Ban), Bang Sai: Village on the Chao Phaya; C.

Bangtang (Ban), Taeng: Village on the Mæ Nam Si Kuk; C.

Bantad (Khao), Banthat: Mountain E. of Krat; SE.

Bantad (Thiu Khao), Banthat, Chaîne de l'Éléphant: Coastal mountain range of southeastern Thailand and southwestern Cambodia; SE.

Bhanam Bencha (Khao), Phanom Bencha: Mountain near Krabi; P.

Biserat (Muang), Yala, Jalor: Village on the Mæ Nam Pattani about 23 miles S. of Muang Pattani; P.

Borapet (Bung), Boraphet: Large artificial lake near Pak Nam Pho; C.

Borapet (Khlong), Boraphet: Waterway connecting Bung Boraphet with the Mæ Nam Chao Phaya; C.

Bua Yai (Ban): Village on the railway between Khorat and Khon Kaen, about 50 miles NNE. of Khorat; E.

Chaiburi (Muang), Bung Kan (Ban): Village on the Mæ Khong about 81 miles NE. of Udon Thani; E.

Chainad (Muang), Chai Nat: Town on the Chao Phaya about 35 miles S. by E. of Nakhon Sawan; C.

Chaiya (Muang), Phum Riang (Ban); Village on the Bight of Ban Don about 14 miles NNW. of Ban Don; P.

Cham Ham (Ao), Cham Han: Bight of the Gulf of Siam W. of Chanthaburi; SE.

Chan (Huai, Mæ Nam): Stream on which Chiang Sæn Mai is situated; N.

Chang (Ko): Large island in the Gulf of Siam SW. of Krat; SE.

Chantabun (Mæ Nam), Chanthabun: River flowing into the Gulf of Siam on which Chanthaburi is situated; SE.

Chantabun (Muang), Chanthabun, Chanthaburi: Town on the Chanthabun River about 134 miles SE. of Bangkok; SE.

Chao Chet (Mæ Nam): Stream, tributary to the Chao Phaya, which it enters at Ban Pho about 6 miles SSE. of Ayutthaya; C.

Chao Phya (Mæ Nam), Chao Phaya, Chao Phraya: Great river flowing into the head of the Inner Gulf of Siam, formed by confluence of the Mæ Ping and the Mæ Nan at Pak Nam Pho and Nakhon Sawan; C.

Chawang (Khlong): Mountain stream E. of Ban Don; P.

Chem (Mæ Nam), **Chaem**: Stream, tributary to the Mæ Ping, which it enters from the west about 45 miles SW. of Chiang Mai; N.

Cheo (Mæ Nam), **Chieo**: Stream in Krat Province; SE.

Chi (Mæ Nam): Large river, tributary to the Nam Muu, which it enters about 8 miles W. of Ubon Racha Thani; E.

Chiengdao (Muang), **Chiang Dao**: Village between Doi Chiang Dao and the Mæ Nam Ping, about 40 miles N. of Chiang Mai; N.

Chiengdao (Doi), **Chiang Dao**: High mountain (over 7,000 feet) about 40 miles N. by W. of Chiang Mai; N.

Chiengmai (Muang), **Chiang Mai**: City on the Mæ Ping, terminus of the Northern Line of the Royal State Railways, about 356 miles N. by W. of Bangkok; N.

Chiengrai (Muang), **Chiang Rai, Chiang Hai**: Town on the Mæ Nam Kok about 92 miles NE. by N. of Chiang Mai; N.

Chiengsen (Muang), **Chiang Sæn, Chiang Sæn Kao. Old Chiang Sæn**: Ruined city on the right bank of the Mæ Nam Khong about 15 miles NE. of Chiang Sæn Mai; N.

Chiengsen (Muang), **Chiang Sæn, Chiang Sæn Mai, New Chiang Sæn**: Town on the Mæ Nam Chan about 17 miles N. by E. of Chiang Rai; N.

Chik (Ko): Islet in the Gulf of Siam; SE.

Chom (Mæ Nam): Stream tributary to the Mæ Ping; ?N.

Chomtong (Muang), **Chom Thong, Luang** (Ban): Town on right bank of the Mæ Ping about 30 miles SW. of Chiang Mai; N.

Chong (Khao): Mountain near Trang; P.

Chong (Lam Nam Tok): Waterfall stream dropping from Khao Chong near Trang; P.

Chula (Ko): Rocky islet near the mouth of the Chanthabun estuary; SE.

Chumporn (Muang) **Chumphon, Tha Taphao** (Ban): Coastal town on the eastern side of the Isthmus of Kra about 150 miles NNW. of Nakhon Si Thammarat; P.

Den Lao (Thiu Khao), **Daen Lao**: Mountain range on the Thai-Shan frontier in which the Mæ Nam Ping has its source; N.

Dha Luang (Ban), **Tha Luang**: Village on the Mæ Pa Sak, the center of extensive irrigation works; C.

Don (Ban), **Surat Thani**: Coastal town at the mouth of the Mæ Nam Ban Don, about 65 miles NW. of Nakhon Si Thammarat; P.

Don Lao (Khlong): Stream tributary to the Mæ Nam Tha Chin; C.

Dong Pek (Thiu Khao), **Dong Ræk**: Mountain range forming the divide between the basins of the Mæ Nam Mun and the Mæ Nam Bang Pakong and farther to the east forming the frontier between Thailand and Cambodia.

Dong Phya Yen (Thiu Khao), **Dong Phaya Yen**: Mountain range forming the southern part of the divide between the basins of the Chao Phaya and the Mæ Khong; C., E.

Fang (Mæ Nam): River tributary to the Mæ Kok, which it enters about 18 miles NE. by E. of Muang Fang; N.

Fang (Muang): Village on the Mæ Fang about 41 miles W. of Chiang Rai; N.

Haeng (Mæ Nam): Stream tributary to the Mæ Nam Nan, which it enters from the SW. by W. about 18 miles S. of Muang Nan; N.

Han (Nong): See Lahan (Nong).

Hang Kraben (Mæ Nam), **Hang Kaben**: Anabranch of the Mæ Nam Chao Phaya above Ayutthaya; C.

Hoi Toi (Ban), **Hua Toei**: Station on the Southern Line of the Royal State Railways about 11 miles W. of Ban Don; P.

Hu Puang (Huai), **Hu Phuang**: Tiny brook tributary to the Mæ Nam Mao; N.

Hua Hin (Ban): Seaside village on the Gulf of Siam about 87 miles SSW. of Bangkok; C.

Hua Mak (Ban): Village on railway about 8 miles E. of Bangkok; C.

Hua Mot (Doi): High mountain (over 6,000 feet) situated just N. of Doi Langka (Doi Pha Cho); N.

Huey Ta (Ban), **Huai Ta**: Village W. of Nakhon Si Thammarat at the base of Khao Luang; P.

Huey Yang (Ban), **Huai Yang**: Village about 158 miles SSW. of Bangkok; C.

Hupbon (Ban), **Hup Bon**: Village near Ban Si Racha; SE.

Ing (Mæ Nam): River, tributary to the Mæ Khong, on which Muang Thœng is situated; N.

Jhering: See Yamoo (Ban).

Ka (Huai): Stream flowing between Doi Chiang Dao and the next mountain to the south; N.

Kahten (Ko), **Katen, Kraten**: Islet in the Gulf of Siam S. of Ko Samui; P.

Kam (Mæ Nam): River draining Nong Lahan and tributary to the Mæ Khong, which it enters about 46 miles ESE. of Sakon Nakhon; E.

Kanburi (Muang), **Kanchanaburi**: Town on the Mæ Klong, at the junction of the Khwæ Yai and the Khwæ Noi, about 36 miles NW. by N. of Ratchaburi; C.

Kao (Huai), **Kæo**: Stream arising on Doi Suthep and entering the Mæ Ping at Chiang Mai; N.

Kemarat (Ban), **Khemmarat**: Village on the Mæ Khong about 61 miles NNE. of Ubon Racha Thani; E.

Keng Sok (Ban), **Kaeng Sok**: Village (on the Mæ Klong?) stated to lie in southwestern Thailand; C.

Khan (Mæ Nam): Stream, tributary to the Mæ Ping, which it enters from the north about 20 miles SSW. of Chiang Mai; N.

Khana (Ban): Village on the Mæ Nam Kon about 39 miles N. by E. of Muang Nan; N.

Khong Noi (Mæ Nam): Stream tributary to the Mæ Nam Pai near Mæ Hong Son; N.

Khor (Nong), **Kho**: Lake near Si Racha; SE.

Khun Tale, Khun Thale: Lakelike expansion of the Mæ Nam Ta Pi above the town of Ban Don; P.

Khun Tan (Doi), **Nga Chang**: Mountain (over 4,000 feet) situated above Khun Tan station, about 29 miles SE. by S. of Chiang Mai, sometimes recorded by Dr. Smith as Khun Tan Mountains; N.

Khun Tan (Thiu Khao): Mountain range forming the divide between the basins of the Mæ Ping and the Mæ Wang; N.

Kirirat (Mæ Nam), **Khirirat**: River tributary to the Ta Pi above Ban Don; P.

Kiriwong (Ban), **Khiriwong**: Village at the headwaters of the Mæ Nam Tadi, about 16 miles W. of Nakhon Si Thammarat; P.

Klang Pla (Mæ Nam), **Kang Pa, Ka Pak**: stream on Doi Ang Ka, tributary to the Mæ Klang or Mæ Kang from the north and formed by confluence of the Mæ Ka Pak Luang and the Mæ Ka Pak Noi near Ban Nong Lom; N.

Klong (Mæ Nam): River entering the Inner Gulf of Siam at its northwestern corner formed by confluence of the Khwæ Yai and the Khwæ Noi; C.

Koh Lak (Ban), **Ko Lak, Prachuap Khirkhan** (Muang): Seaside village on the Gulf of Siam about 140 miles SSW. of Bangkok; C.

Kok (Mæ Nam): River, tributary to the Mæ Khong, on which Chiang Rai is situated; N.

Kok Kamyan (Khlong): Stream tributary to the Mæ Nam Suphan (Tha Chin) near Suphanburi; C.

Kon (Mæ Nam): Small swift stream (tributary to the Mæ Nam Nan) on which Ban Khana is situated; N.

Kong (Mæ Nam), **Khong**, Cambodia: One of the great rivers of Asia; it forms a great part of the eastern boundary of Thailand.

Kong Kha (Huai), **Kong Ka**: Small stream arising on Doi Mæ Kong Ka and entering the Mæ Yuan from the west near Mæ Sariang; N.

Korat (Muang), **Khorat, Nakhon Rachasima** (Muang): Large town on the upper Nam Mun about 135 miles NE. by E. of Bangkok; E.

Kra (Mæ Nam), **Pak Chan**: River forming the boundary between Thailand and the southernmost part of Tenasserim; P.

Krabi (Muang), **Ghirbi**: Coastal town on the western side of the Malay Peninsula about 76 miles WSW. of Si Thammarat; P.

Krabin (Muang), **Krabinburi**: Town on the Sa Kæo River about 81 miles E. by N. of Bangkok; C.

Kraburi (Muang), **Nam Chut Yai** (Ban): Village on the Mæ Nam Kra or Mæ Nam Pak Chan, about 28 miles W. by S. of Chumphon; P.

Krat (Mæ Nam), **Trat**: Short river entering the Gulf of Siam N. of Ko Kut; SE.

Krat (Muang), **Trat**: Town on the Krat River about 169 miles SE. by E. of Bangkok; SE.

Kuang (Mæ Nam): Stream arising in the vicinity of Doi Langka and entering the Mæ Ping about 16 miles S. by W. of Chiang Mai; N.

Kumpawapi (Muang), **Kumphawapi, Na Khong** (Ban): Village at the headwaters of the Mæ Nam Pao, about 21 miles SE. by S. of Udon; E.

Kut (Ko): Large island in the Gulf of Siam S. by E. of Krat; SE.

Kwe Noi (Mæ Nam), **Khwæ Noi**: Western branch of the Mæ Nam Klong, above Kanchanaburi; C.

Kwe Yai (Mæ Nam), **Khwæ Yai**: Eastern branch of the Mæ Klong above Kanchanaburi; C.

Lahan (Nong), **Han**: Large lake near Sakon Nakhon, draining into the Mæ Khong; E.

Lam Ton Lang (Ban), **Lam Thong Lang**: Village NW. of Pak Chong; C.

Lampam (Ban): Village on the Inner Lake of the Thale Sap; P.

Lampang: See Nakon Lampang (Muang).

Langka (Doi), **Pha Cho**: High mountain (over 6,000 feet) about 32 miles ENE. of Chiang Mai, incorrectly recorded by Dr. Smith as Doi Nang Ka; N.

Langsuen (Muang), **Lang Suan**: Town on the Bight of Ban Don about 118 miles NW. by N. of Nakhon Si Thammarat; P.

Lao (Huai, Mæ Nam): Stream arising on Doi Hua Mot and entering the Mæ Kok from the south about 13 miles NE. of Chiang Rai; N.

Len (Huai): Stream on Doi Hua Mot, one of the headwaters of the Mæ Nam Lao; N.

Lin (Huai): Tiny brook tributary to the Mæ Mao near Ban Muang Sum; N.

Lom (Huai): Small brook tributary to the Mæ Nam Hæng on which Ban San Tha is situated; N.

Long (Mæ Nam): Swift stream tributary to the Mæ Chæm; N.

Lopburi (Mæ Nam): Anabranch of the Mæ Nam Chao Phaya on which Lopburi is situated; C.

Lopburi (Muang): Old capital on the railway about 30 miles N. by E. of Ayutthaya; C.

Lu (Mæ Nam): Small stream tributary to the Mæ Chæm; N.

Luang (Khao): High mountain (almost 6,000 feet) about 15 miles W. by N. of Nakhon Si Thammarat; P.

Luk (Huai): Brook arising on Doi Khun Tan (Doi Nga Chang); N.

Mæ Kong Ka (Doi): Low mountain about 9 miles SW. by W. of Mæ Sariang; W. (sometimes called NW.).

Mæ Sot (Ban): Frontier village about 119 miles NW. by W. of Nakhon Sawan; W.

Mao (Mæ Nam): Stream, tributary to the Mæ Fang, arising on Doi Pha Hom Pok; N.

Mehongsorn (Nuang), Mæ Hong Son: Town on the Mæ Nam Pai about 73 miles WNW. of Chiang Mai; N.

Mekang (Ban), Mæ Kang, Mæ Klang, Kang, Pang Chao: Village on the Mæ Klang or Mæ Kang about 4 miles NW. of Chom Thong and at the foot of Doi Ang Ka; N.

Mekong Kha: See Mæ Kong Ka (Doi).

Menam, Lae Nam: The words for "river," commonly used by foreigners without qualification for the Mæ Nam Chao Phaya; C.

Mesarieng (Ban), Mæ Sariang, Mæ Yuam, Maing Long Gyi: Town on the Mæ Nam Yuam about 80 miles SW. by W. of Chiang Mai; W. (sometimes called NW.).

Mesort: See Mæ Sot (Ban).

Metang (Ban), Mæ Tæng, San Maha Phon: Village on the Mæ Tæng about 21 miles N. by W. of Chiang Mai; N.

Muang Sum (Ban), Muang Chum: Village on the Mae Mao at the base of Doi Pha Hom Pok about 9 miles NNW. of Fang; N.

Mue (Mæ Nam), Mœi, Thaungyin: Large river flowing northwestward into the Salwin and forming part of the boundary between Tenasserim and western Thailand.

Mun (Mæ Nam): Large river tributary to the Mæ Khong, on which Khorat and Ubon Racha Thani are situated; E.

Na Muang (Ban, Tambon): Village on the Mæ Nam Klong; C.

Na Muang (Lam Nam Tok): Waterfall stream on Ko Samui; P.

Nakon Chaisi (Mæ Nam), Nakhon Chai Si: Name applied to the middle reach of the Tha Chin River; C.

Nakon Lampang (Muang), Nakhon Lampang: Large town on the Mæ Wang about 36 miles SE. of Chiang Mai; N.

Nakon Nayok (Mæ Nam), Nakhon Nayok: Short tributary of the Bang Pakong River; C.

Nakon Noi (Khlong), Nakhon Noi: Stream flowing through Nakhon Si Thammarat into the Gulf of Siam; P.

Nakon Sawan (Muang), Nakhon Sawan: Town on the Chao Phaya about 135 miles N. by W. of Bangkok; C.

Nakon Sritamarat (Muang), Nakhon Si Thammarat: Large town near the coast of the Gulf of Siam about 364 miles S. by W. of Bangkok; P.

Nam Poo (Khao), Nam Phu: Locality on the Mæ Pa Sak, probably a hill of the Phetchabun Range; C.

Nam Puat (Ban): Village in the French Enclave about 60 miles N. by W. of Muang Nan; N.

Nan (Mæ Nam): Large river that joins with the Mæ Ping at Pak Nam Pho to form the Chao Phaya; N., C.

Nan (Muang): Town on the right bank of the Mæ Nam Nan about 118 miles E. of Chiang Mai; N.

Nang Ka (Doi), Langka, Pha Cho: High mountain (over 6,000 feet) about 32 miles ENE. of Chiang Mai; N.

Ngeh (Mæ Nam), Nge: Stream tributary to the Mæ Ping; ?N.

Ngop (Muang): Village near the headwaters of the Mæ Nan about 53 miles N. by E. of Nan; N.

Noi (Mæ Nam): Anabranch of the Chao Phaya, which unites with the Mæ Nam Yai and the Lopburi at Ayutthaya; C.

Nong (Khoa): Mountain (over 4,000 feet) in the Nakhon Si Thammarat Range, situated about 27 miles N. by W. of Khao Luang; P.

Nong Tong (Huai), **Nong Thong**: Tiny brook tributary to the Mæ Mao near Ban Muang Sum; N.

Nontaburi (Muang), **Nonthaburi**: Town on the Chao Phaya just N. of Bangkok; C.

Ong (Mæ Nam): Small stream between Chiang Mai and Wiang Pa Pao, probably tributary to the Mae Kuang; N.

Pa Khwang (Ban), **Pha Khwang**: Village on the Nam Nan between Muang Nan and Muang Pua; N.

Pachebon (Muang), **Pechabun**, **Phetchabun**: Town on the Mæ Pa Sak about 85 miles NE. by E. of Nakhon Sawan; C.

Pai (Mæ Nam): River tributary to the Salwin; W.

Pai (Muang), **Wiang Tai** (Ban): Town on the Mæ Pai about 51 miles NW. of Chiang Mai; W.

Pailin (Muang), **Phai Lin**, **Bo Din Nieo** (Ban): Village in Cambodia about 151 miles ESE. of Bangkok; SE.

Pak Bhayoon (Ban), **Pak Phayun**: Village on the Inner Lake of the Thale Sap about 20 miles WNW. of Song Khla; P.

Pakhai (? Ban):? Village; C.

Pakjong (Ban), **Pak Chong**: Railway station about 50 miles WSW of Khorat; E.

Paklat (Ban), **Pak Lat**: Village on the Chao Phaya between Bangkok and the mouth of the river; C.

Paknam (Ban), **Pak Nam**: The words for "estuary" or "river's mouth," commonly used without qualification for Ban Pak Nam Chao Phaya, the fishing village at the mouth of the Chao Phaya C.

Paknampo (Ban), **Pak Nam Pho**: Town at the confluence of the Mæ Nam Nan and the Mæ Nam Ping about 136 miles N. by W. of Bangkok C.

Paknam Wain (Ban), **Pak Nam Wen**: Village at the mouth of the Mæ Nam Wen; SE.

Pakpayum (Ban), **Pak Bhayoon**, **Pak Phayun**: Village on the Inner Lake of the Thale Sap about 20 miles WNW. of Song Khla; P.

Pakret (Ko), **Pak Kret**: Island in the Chao Phaya N. of and near Bangkok; C.

Pak Thawan (Ban): Village on the Mæ Nam Pran; C.

Pan (Ban), **Phæn**: Village on the Mæ Nam Si Kuk; C.

Pang Chao (Ban), **Mæ Klang**, **Mæ Kang**, **Kang**: Village on the Mæ Klang or Mæ Kang about 4 miles NW. of Chom Thong and at the foot of Doi Ang Ka; N.

Pa-ngan (Ko): Island in the Gulf of Siam north of Ko Samui; P.

Pasak (Mæ Nam), **Pa Sak**, **Sak**: River, tributary to the Chao Phaya, which it enters from the northeast near Ayutthaya; C.

Patalung (Mæ Nam), **Phatthalung**: Stream, tributary to the Thale Sap, on which Phatthalung is situated; P.

Patalung (Muang), **Phatthalung**: Town near the Inner Lake of the Thale Sap about 56 miles S. by E. of Si Thammarat; P.

Patani (Mæ Nam), **Pattani**: River, flowing into the Gulf of Siam, at the mouth of which Pattani is situated; P.

Patani (Muang), **Pattani**: Large coastal town near the mouth of the Gulf of Siam about 51 miles ESE. of Song Khala; P.

Patani States, Pattani States: The petty Malay sultanates which were combined to form the Province of Pattani; P.

Pau (Mæ Nam), Pao: River, tributary to the Nam Chi, on which Kumphawapi is situated; E.

Payao (Muang), Phayao, Phrayao, Nai Wiang (Ban): Village about 65 miles NNE. of Nakhon Lampang; N.

Payao (Nong, Kwan), Phayao, Phrayao: Lake near the village of Phayao; N.

Pechabun (Muang), Phetchabun: Town on the Mæ Nam Pa Sak about 85 miles NE. by E. of Nakhon Sawan; C.

Pechabun (Thiu Khao), Phetchabun: Mountain range forming the northern part of the divide between the basins of the Chao Phaya and the Mæ Khong; C., E., N.

Petchaburi (Muang), Pechaburi, Phetchaburi: Town on the Phetchaburi River about 31 miles S. by E. of Rachaburi; C.

Petrieu (Ban), Paetriu: Village on the Mæ Nam Bang Pakong about 39 miles E. by S. of Bangkok; C.

Phra Pathom (Ban): Village on the Mæ Nam Tha Chin; C.

Phu-Quoc (Ko), Phukok: Large island in the Gulf of Siam, part of Cochin-China but lying off Kampot in Cambodia.

Pi Pan Nam (Thiu Khao), Phi Pan Nam: Two parallel chains of hills, the more western forming the divide between the basins of the Mæ Wang and the Mæ Yom, the more eastern forming the divide between the Mæ Yom and the Mæ Nan; N.

Ping (Mæ Nam): Large river which joins with the Mæ Nan at Pak Nam Pho to form the Chao Phaya; N., C.

Pipedon (Ko), Phiphidon: Small island off the western coast of Peninsular Thailand lying SE. of Ko Yao Yai; P.

Pitsanulok (Muang), Phitsanulok: Town on the Mæ Nam Nan about 210 miles N. of Bangkok; C.

Pla Talum Puk (Læm): Long sandy spit extending northward into the Gulf of Siam just E. of Nakhon Si Thammarat; P.

Pliew (Huai), Phliu: Waterfall stream arising on Khao Sabap; SE.

Po (Ban), Pho: Village on the Chao Phaya about 36 miles N. by E. of Bangkok; C.

Pong (Ban): Village on the Mæ Klong about 20 miles N. by E. of Rachaburi; C.

Pong (Ban), Nam Phong: Village on the Nam Phong about 130 miles NNE. of Khorat; E.

Pong (Khlong): Stream W. of Nakhon Si Thammarat near the base of Khao Luang; P.

Pong (Mæ Nam), Phong: River tributary to the Nam Chi, which it enters from the N. by E. about 111 miles NNE. of Khorat; E.

Poom Duang (Mæ Nam), Phum Duang: Stream at whose mouth Muang Chaiya is situated; P.

Poon (Mæ Nam), Phum: Stream tributary to the Mæ Yom, probably that which enters the main river about 43 miles SW. of Muang Phrae; C.

Potaram (Ban), Photharam: Village on the Mæ Klong about 13 miles N. by E. of Rachaburi; C.

Prachin (Mæ Nam): Name applied to the middle reach of the Bang Pakong; C.

Prachin (Muang), Prachinburi: Town on the Bang Pakong River about 61 miles ENE. of Bangkok; C.

Præ (Muang), Phræ: Town on the Mæ Yom about 88 miles SE. by E. of Chiang Mai; N.

Pran (Muang), **Pranburi**, **Pak Khlong Pran** (Ban): Coastal village at the mouth of the Pran River about 99 miles SSW. of Bangkok; C.

Pran (Mæ Nam): Short river entering the Inner Gulf of Siam on the western side near its mouth; C.

Pratip (Nong), **Prathip**: Pond at Chiang Mai near the railway station; N.

Pua (Muang): Village on the Mae Khwang about 31 miles NNE. of Muang Nan; N.

Puat (Huai, Mæ Nam): Stream in the French Enclave on which Ban Nam Puat is situated, tributary to the Mæ Nam Khop (an affluent of the Mæ Nam Khong); N.

Puket (Ko), **Phuket**: The largest island off the western coast of Peninsular Thailand; P.

Raheng (Ban), **Rahaeng**, Tak (Muang): Town on the left bank of the Mæ Ping about 101 miles NW. by N. of Nakhon Sawan; C.

Raibon (Khlong), **Rai Bon**: Stream near Muang Krat; SE.

Rajaburi (Muang), **Ratchaburi**, **Ratburi**: Large town on the Mæ Klong about 49 miles WSW. of Bangkok; C.

Ranoad (Khlong), **Ranot**: Stream flowing from the west into the Inner Lake of the Thale Sap; P.

Rayong (Muang): Fishing village on the Gulf of Siam about 90 miles SE. by S. of Bangkok; SE.

Ronpibun (Ban), **Ron Phibun**: Village about 19 miles SSW. of Nakhon Si Thammarat; P.

Sabap (Khao): Mountain near Chanthaburi; SE.

Sai Nok Riang (Huai): Brook tributary to the Mæ Nam Phum Duang at Muang Chaiya; P.

Saiburi (Mæ Nam), **Taluban**: Stream arising in the mountains where Thailand, Perak, and Kelantan meet and entering the Gulf of Siam near its mouth at Saiburi; P.

Saiburi (Muang), Saraburi, Saburi: Town on the Mæ Pa Sak about 60 miles NE. by N. of Bangkok; C.

Saiyok (Ban), **Sai Yok**: Village on the western branch (Khwæ Noi), of the Mæ Klong about 88 miles NW. of Rachaburi; C.

Sak (Mæ Nam), **Pa Sak**: River, tributary to the Chao Phaya, which it enters from the northeast near Ayutthaya; C.

Sakeo (Ban), **Sa Kæo**: Village about 101 miles E. of Bangkok; C.

Sakeo (Mæ Nam), **Sa Kæo**: Stream, tributary to the Bang Pakong River, on which Krabinburi is situated; C.

Sakon Nakon (Muang), **Sakon Nakhon**: Town about 145 miles NNW. of Ubon Racha Thani; E.

Salwin (Mæ Nam), **Salween**, **Salawin**, **Mæ Khong**: One of the great rivers on Asia; it forms part of the western boundary of Thailand.

Samet (Nong): Marsh or pond near Chanthaburi; SE.

Samrong (Khlong): Canal near Bangkok connecting the Mæ Nam Chao Phaya with Mæ Nam Bang Pakong; C.

Samui (Ko): Large island in the Gulf of Siam N. of Nakhon Si Thammarat; P.

Sao Tong (Ban), **Sao Thong**: Village on the highway between Nakhon Si Thammarat and Ron Phibun; P.

Sarahet (Ban): Village on the Mæ Nam Phetchaburi, 5 days by poled boat or 16 hours by motorboat above Phetchaburi; C.

Seming (Khao), **Saming**: Mountain (over 4,000 feet) about 23 miles NE. by E. of Krat; SE.

Si Koh Ha (Ko), **Si Ko Ha**: Limestone island in the Thale Sap; P.

Sichang (Ko), **Si Chang**: Island of the Inner Gulf of Siam W. by S. of Si Racha; SE.

Sichon (Ban): Coastal village on the Gulf of Siam about 38 miles N. by W. of Nakhon Si Thammarat; P.

Sikuk (Mæ Nam), **Si Kuk**: Stream tributary to the upper Mæ Nam Chao Phaya; C.

Silom (Khlong), **Si Lom**: Canal in the city of Bangkok; C.

Sing (Læm): Cape enclosing the Chanthabun estuary to the west, about 10 miles SSW. of Chanthaburi; SE.

Singora (Muang), **Singgora, Song Khla**: Town on the Gulf of Siam at the mouth of the Thale Sap about 95 miles SSE. of Nakhon Si Thammarat; P.

Soi (Mæ Nam): Stream arising on Doi Langka (Doi Pha Cho) and flowing into tributary of the Mæ Nam Wang N. of Nakhon Lampang; N.

Sok (Khlong): One of the western headwaters of the Mæ Nam Ta Pi; P.

Songkram (Mæ Nam), **Song Khram**: River tributary to the Mæ Khong, which it enters from the W. about 39 miles NE by N. of Sakon Nakhon; E.

Sot (Mæ Nam): Stream, tributary to the Mæ Mœi, on which Ban Mæ Sot is situated; W.

Sriracha (Ban) **Si Racha, Si Maha Racha**: Town on the eastern shore of the Inner Gulf of Siam about 50 miles SE. by S. of Bangkok; SE.

Srisawat (Ban), **Si Sawat**: Village on the eastern branch (Khwæ Yai) of the Mæ Klong about 94 miles NW. by N. of Rachaburi; C.

Supan (Mæ Nam), **Suphan**: Name applied to the upper reach of the Tha Chin River; C.

Supanburi (Muang), **Suphanburi**: Town on the Mæ Nam Suphan (Tha Chin) about 55 miles NNW. of Bangkok; C.

Surin (Mæ Nam): River tributary to the Mæ Pai, which it enters about 20 miles WSW. of Muang Mæ Hong Son; W.

Sutep (Doi), **Suthep**: Mountain (5,500 feet) rising steeply from the plain just W. of Muang Chiang Mai; N.

Ta (Mæ Nam), **Tha**: Stream arising in the Khun Tan range and entering the Mae Kuang about 16 miles S. by W. of Chiang Mai; N.

Ta Chang (Ban), **Tha Chang**: Railway station on the Nam Mun about 11 miles E. by N. of Khorat; village on a tributary of the Nam Mun W. of Khorat; E.

Ta Fang (Ban), **Tha Fang**: Misinterpretation of That Fang; see Ta Ta Fang.

Ta Ta Fang (Ban), **Thattafang, That Fang**: Village on the left bank of the Salwin about 18 miles WSW. of Mae Sariang; N.

Tachalom (Ban), **Tha Chalom**: Village on the Mæ Nam Tha Chin; C.

Tachin (Mæ Nam), **Tha Chin**: River which enters the head of the Inner Gulf of Siam just W. of the mouth of the Chao Phaya; C.

Tadi (Mæ Nam), **Ta Di**: Stream arising on Khao Luang and passing through Nakhon Si Thammarat to enter the Gulf of Siam; P.

Taeng (Ban), Village on the Krat River near Muang Krat; SE.

Tai (Ban), **Thai**: Village on the Mæ Khong in Udon Providence; E.

Takuapa (Muang), **Takua Pa**: Town on the western side of the Malay Peninsula about 115 miles W. by N. of Nakhon Si Thammarat ; P.

Tale Noi, Thale Noi: A small fresh-water extension of the Thale Sap at the NW. corner of the Inner Lake; P.

Tale Sap, Thale Sap Song Khla, Inland Sea of Singgora: An almost landlocked arm of the Gulf of Siam extending W. and NW. of Singgora or Song Khla; it is divided into the salty Outer Lake and the brackish Inner Lake; P.

Talebun (Ban), **Taleban, Saiburi** (Muang): Coastal town at the mouth of the Mæ Nam Saiburi about 26 miles ESE. of Pattani; P.

Tam (Ban), **Tham:** Village near a famous cave at the eastern base of Doi Chiang Dao; N.

Tang (Mæ Nam), **Tæng:** River confluent with the Mæ Ping at Ban Mæ Tæng or San Maha Phon; N.

Tanon Tong Chai (Thiu Khao) **Thanon Thong Chai:** Mountain range forming the divide between the basins of the Salwin and the Mæ Ping; NW.

Tao (Ko): Island in the Gulf of Siam NW. by N. of Ko Pa-ngan; P.

Tapi (Mæ Nam), **Ta Pi, Ban Don:** River flowing north to enter the Gulf of Siam at Ban Don; P.

Thalerng (Khlong), **Ta Lœng:** Stream near Ron Phibun; P.

Thaungyin (Mæ Nam), **Thaungyeen, Mœi:** Large river flowing northwestward into the Salwin and forming part of the boundary between Tenasserim and western Thailand.

Thœng (Muang), **Nai Wiang** (Ban): Town on the Mæ Ing about 28 miles SE. by E. of Chiang Rai; N.

Thung Luang (Ban): Village about 85 miles SW. by S. of Bangkok; C.

Ton (Mæ Nam): Stream arising on Doi Langka (Doi Pha Cho) and flowing into a tributary of the Mæ Nam Ping NE. of Chiang Mai; N.

Ton Lang (Lam), **Thong Lang:** Stream tributary to the Mæ Nam Pa Sak from the east on which Ban Lam Thong Lang is situated; C

Tonburi (Muang), **Thonburi:** Part of Bangkok, on the right bank of the Chao Phaya; C.

Trang (Mæ Nam): Small river on which the town of Trang is situated; P.

Trang (Muang), **Thap Thiang** (Ban): Town on the Mæ Nam Trang about 63 miles SSW. of Nakhon Si Thammarat; P.

Tum (Mæ Nam): Swift stream tributary to the Mæ Chaem; N.

Tung Song (Muang), **Thung Song, Chamai** (Ban): Railway junction about 26 miles SW. of Nakhon Si Thammarat; P.

Ubon (Muang), **Ubon Racha Thani:** Town on the Nam Mun, terminus of the Eastern Line of the Royal State Railways, about 184 miles E. of Khorat; E.

Udon (Muang), **Udon Thani, Mak Khæng** (Ban): Town about 174 miles N. by E. of Khorat; E.

Um Meng (Huai): Swift brook, tributary to the Mæ Chæm, which it enters from the east about 21 miles W. of Chom Thong; N.

Umpang (Ban), **Um Phang:** Village near the Tenasserim frontier about 85 miles W. of Nakhon Sawan; C.

Umpang (Huai), **Um Phang:** Stream, one of the headwaters of the Mæ Klong Khwæ Yai, on which Ban Um Phang is situated; C.

Wain (Mæ Nam), **Wen:** Short river flowing into the Gulf of Siam near Chanthaburi; SE.

Wang (Mæ Nam): River tributary to the Mæ Ping; watering the country between the Khun Tan and western Phi Pan Nam Ranges; N., C.

Wieng Papao (Muang), **Wiang Pa Pao, Nai Wiang** (Ban): Village on the Mæ Nam Lao about 41 miles SSW. of Chiang Rai; N.

Wong (Mæ Nam): River tributary to the Chao Phaya, which it enters from the NW. by N. about 26 miles S. of Nakhon Sawan; C.

Yai (Ko): Island in the Chao Phaya between Bangkok and Ayutthaya; C.

Yai (Mæ Nam): Anabranch of the Chao Phaya which unites with the Mæ Nam Noi and the Lopburi at Ayutthaya; C.

Yamoo (Ban), **Yamu, Yaring** (Muang), **Jhering:** Coastal village about 8 miles E. of Pattani; P.

Yang (Nong): Small lake E. of Si Racha; SE.

Yao Yai (Ko), **Panjang** (Pulau): Large island off the western coast of Peninsular Thailand lying just E. of Ko Phuket; P.

Yom (Mæ Nam): River tributary to the Mæ Nan, watering the country between the eastern and western Phi Pan Nam Ranges; N., C.

Yuam (Mæ Nam): River tributary to the Salwin, on which Mæ Sariang is situated; W.

LEADING FEATURES OF THE FISH FAUNA

A fresh-water fish fauna of great variety and abundance has developed in Thailand as a result of peculiarly favorable physical and biological conditions. The country extends through 16° of latitude (5° to 21° N.) and 9° of longitude (97° to 106° E.) and has an exceedingly diverse topography, comprising mountains, elevated plateaus, flat alluvial plains, interior and coastwise swamps and marshes, and mountainous and low islands, some of considerable size. About 70 percent of the surface is forest-clad, and mountains and lowlands contain innumerable brooks, rivers, canals, and lakes, and the plains have an intricate system of connecting and intersecting watercourses.

Under the influence of the southwest monsoon, there exists over most of the country a wet season of daily rainfall, which lasts from April to November, with an average yearly precipitation of 1,600 mm. (63 inches). The amount of rainfall varies considerably in the different parts of the country and may average over 3,000 mm. (120 inches) in some places and only 900 mm. (36 inches) in others. The rainy season is followed by a cool, dry, or winter season, under the influence of the northeast monsoon, extending from November to February, during which practically no rain falls. Between the cessation of the dry season and the beginning of the wet season there is a short hot transition or summer season.

The annual inundation of the vast central plain of Thailand and of the various minor plains is an event of great importance in the life of all the fishes. As the streams begin to rise and fill their beds, together with the connecting canals, and the tributary ponds, lakes, swamps, and marshes that had become reduced during the protracted dry season, the fishes follow the flood waters, into the ricefields, into the lakes, and into the swamps being converted into lakes; and by the time the inundation has reached its height the vast majority of the free-swimming fishes have spawned. With the falling of the flood waters, the adults move back into the river channels, leaving the young to follow in accordance with their rate of growth and respective needs. The flood waters give protection to the young, which in general have a rapid growth and many attain maturity in one year.

Outstanding among the fresh-water fishes are the Cyprinidae, which are the most numerous as regards genera and species and the most abundant as regards individuals. The present catalog recognizes 55 genera and 206 species. Some of the genera are peculiar to Siam, some range into the contiguous countries, and into India, China, and the

Indo-Australian Archipelago. There is no brook, rivulet, river, canal, or lake in which the family is not represented; and a net or trap may hardly be drawn anywhere at any time without yielding one or more species. Some species occur in incredible numbers in certain places at certain times, others may be found only singly, and several striking species are as yet known from only single specimens. The whole gamut of size among cyprinoid fishes is run by the family in Thailand from the most diminutive only 2 cm. long to the colossal *Catlocarpio siamensis*, peculiar to Thailand and French Indo-China, which attains a length of 3 meters and may be the largest member of the family. From the viewpoint of the domestic food supply, the family is of incalculable importance.

A very prominent element in the fresh-water fish fauna is the loaches (Cobitidae). Herein recognized are 8 genera and 38 species. Several genera are peculiar to Thailand, and a number of species belonging to genera widely distributed in southern Asia and the Indo-Australian Archipelago are known only from this country. These fishes are characteristic of mountain streams, where they bury themselves in sand and gravel. Some, however, lacking the burying habit, are found in large, muddy rivers and even in lakes.

A very conspicuous feature of the fauna is the abundance of catfishes (Nematognathi) as regards both species and individuals. The local representatives herein considered fall into 10 families, 34 genera, and 100 species. Some of them are found only in mountain brooks, some only in the large rivers, and some throughout certain river basins from their headwaters to their brackish-water mouths. Two pangasiids are among the largest catfishes in the world; one species, *Amblyceps mangois*, is among the smallest. In one family (Sisoridae) some genera have a thoracic adhesive apparatus enabling the fish to cling to stones in swift current; other genera have the whole underside of the head and the pectoral and ventral fins modified so as to serve as an adhesive organ. All the members of one family (Clariidae) have an accessory breathing organ, occupying a cavity on each side of the head above the gills. In one family (Heteropneustidae) there is a supplementary respiratory apparatus consisting of two long hollow cylinders extending among the muscles of the back. In at least three genera of one family (Tachysuridae) comprising many species the eggs are incubated in the mouth of the male.

The tendency of certain kinds of flatfishes in various parts of the world to establish themselves in fresh water is manifested in a striking manner in Thailand where representatives of three soleid genera are found far inland in places where the water is always fresh. Some of these fishes are met with several hundred miles from the sea above rapids that are believed to be nonnegotiable by such fishes. No observations have been made on the spawning habits, eggs, hatching, and development of the young of these fresh-water flatfishes, which are worthy of special study.

Everywhere observable and constituting a salient feature of the fish life of streams, lakes, swamps, and marshes are the serpenthead fishes, the Ophicephalidae, which are represented by eight species.

The Anabantidae are largely represented in Thailand. In some of the local genera, six in number, the gills appear inadequate to maintain the necessary respiratory functions, and the fishes are dependent on atmospheric oxygen, which they are able to appropriate by means of accessory breathing organs developed from the branchial arches and occupying special cavities in the head. These fishes are monogamous and blow masses of glutinous bubbles for the reception of their eggs. Several members of the family are among the choicest of Oriental food fishes, and several are among the most attractive of aquarium fishes.

Conspicuous fishes on flats and river banks exposed at low tide are the periophthalmid gobies, whose movements and antics out of water afford never-ending amusement to human observers. Inasmuch as these fishes are sometimes seen resting with their caudal fin and posterior part of their body still in the water and with the fore parts and head propped up by their pelvic fins, some persons have asserted that the submerged caudal fin is employed as a respiratory organ. This statement does not rest on adequate observation or on sound physiological grounds. The brief aerial excursions of these fishes on the mud flats do not necessitate the invoking of a special caudal breathing apparatus. The gills, in their closely shut-in cavities, retain sufficient moisture to sustain the respiratory processes until the fish plunge into their burrows or into open water. On emerging from the water they proceed cautiously and may at first expose only their eyes or the anterior part of the body until the absence of danger is assured, but more frequently than otherwise the observational point is wholly out of the water, on a mud flat, on a shell or stone, on a stick, or on the root of a mangrove tree. This subject has been dealt with by Dr. Sunder Lal Hora, of the Zoological Survey of India, who has had ample opportunity for observation and abundant material for experimentation. His conclusion is that the caudal fin in these fishes does not and cannot serve as a respiratory organ. Scarcely less noteworthy than the aerial movements is the degree to which aerial vision has developed, enabling the fish to detect, pursue, and capture small food objects on the tide flats.

SOME PECULIARITIES OF STRUCTURE AND HABITS AMONG THE FRESH-WATER FISHES

In a preceding section reference was made to the development in two families of catfishes, the Clariidae and the Heteropneustidae, and in the Anabantidae of respiratory apparatus accessory to the gills. In the Clariidae the accessory organ, occupying a large chamber above each gill cavity, is an outgrowth of the fourth gill arches and consists of an arborescent structure that provides a large surface for the absorption of the atmospheric air reaching it through the mouth. In the Anabantidae a similar organ, arising from the fourth gill arch, is composed of a set of superimposed leaflike plates, which afford a large absorptive surface. In the Heteropneustidae an entirely different accessory breathing organ is found. Extending from the pharynx among the muscles of the back on each side of the vertebral column is a long cylindrical tube, richly supplied with blood vessels and serving as a primitive lung. These tubes, into which both water and air are taken and from which water and air are forced by muscular action, enable the fish to obtain the requisite quantity of oxygen while living in hot, shallow, stagnant ditches and in other places where the water does not contain enough air to support life.

Although the Ophicephalidae lack the elaborate air-breathing organs met with in the aforementioned families, they have a large suprabranchial cavity lined with puckered vascular epithelium, which serves the same purpose.

It has been shown by repeated observation and experimentation on the clariids and anabantids in Thailand that even in well-aerated water the gills may not provide enough oxygen to satisfy the requirements of the system, and death may ensue in a comparatively short time (20 to 30 minutes in some cases) if the fish are prevented from going to the surface to expel vitiated air and take in gulps of fresh air. We may recognize here an evolutionary process that in time may eliminate the gills and make these fishes entirely air-breathing.

Associated with possession of air-breathing apparatus is the ability of some kinds of fishes to live out of water for protracted periods, if the respiratory chambers remain moist. Under the stress of drought, when the waters gradually evaporate and ponds and small streams disappear until the return of the rainy season, some of these fishes habitually go deeper and deeper into the mud and ultimately occupy damp pockets, at depths up to a meter, where they aestivate. Aestivation in the case of Thailand air-breathing fishes consists of enforced inactivity and greatly reduced metabolism while they are buried under parched earth in a stratum of damp mud during the dry season, the limited nutritional needs of the system being supplied by the absorption of stored fat and other food material and the vital processes being maintained largely by the utilization of atmospheric air, which reaches the respiratory chambers through the cracked or porous overlying earth. One can imagine the subterranean tragedies that may occur when the desiccation of the soil is continued beyond the muddy pockets in which the fishes have taken final refuge.

One of the striking phenomena connected with fresh-water fishes in Thailand, as in other Oriental countries, is the sudden appearance, on a field or swamp bed that has been dry for months and cut off from any watercourse, of good-sized fishes after a torrential downpour at the beginning of the rainy season. Such a manifestation, so mystifying to the uninitiated, is easily explained when one recognizes the presence of buried aestivating fishes, which eagerly make their way to the surface when a copious rain floods and softens the dry soil.

The ability to breathe atmospheric air and to exist out of water for a considerable time has led to another extraordinary habit in *Clarias*, *Anabas*, and other fishes, namely, the voluntary leaving of the water and traveling on land, sometimes across dusty roads, sometimes on dry lawns. The impelling influence may be a desire to find improved physical conditions, to seek a better food supply, or to escape enemies. Progress out of water is by lateral movements of the tail as in swimming, while the body is maintained in an upright position by the paired fins. Detailed accounts of actually observed performances of *Clarias batrachus* and *Anabas testudineus* will be found in the appropriate systematic discussions.

A large number of cyprinoid fishes, representing many genera, which are constantly or during a part of the year subjected to a swift current, exhibit flanges on the fin rays. The radial flanges are most prominent on the dorsal and anal fins but are to be seen also on the ventrals and pectorals. They extend outward and backward along the whole length of each ray and decrease in width from the base outward. They form a complete overlapping buffer for the interradial membranes. No description of these accessory parts of the fin rays of swift-water fishes has been met with in the literature, and no explanation of their function seems to have been given.

In the writer's opinion the radial flanges serve to protect the delicate interradial membranes from the injury they would receive from the constant impact of particles of sand and silt in rapid downstream motion. With a fish in its normal position, with head upstream, sharp-edged particles are effectively deflected from the membranes. It is conceivable that, in the absence of such protection, the membranes either might become completely worn through, and thus the usefulness of the fins be destroyed, or, responding to the constant irritation, might become thickened and thus impair the flexibility of the fins.

These appendages reach their highest development in fishes that live in mountain streams, and are absent or only feebly developed in lake, pond, and sluggish-stream fishes.

The present author has observed the flanges in certain Indian fishes. Dr. Hora, the keenest student of Indian fishes, states that he has formed no opinion in regard to these structures.

Mention has been made of the practice of oral incubation in the three genera of Siamese catfishes of the family Tachysuridae. Associated with this habit is the existence of secondary sexual characters in both sexes, consisting in the male of a longer head, larger oral cavity, more posterior insertion of pectoral and ventral fins, and smaller ventral fins, and the development in the female on the inner ventral rays of peculiar pads whose shape varies with the species. A consequence of oral incubation is that the male, having taken in a batch of eggs, is prevented from feeding until hatching ensues and the young leave his mouth after the absorption of the yolk-sac. Similarly, in the female feeding becomes more and more difficult with the growth of the enormous eggs, and a point is reached when the digestive organs are so compressed that they become nonfunctional, and no food can enter the stomach or intestines. It naturally follows that by the time the eggs are laid and the protracted hatching period is over both parents become much emaciated. This subject is discussed at some length in the systematic treatment of the Tachysuridae.

INTRODUCED SPECIES

A few species of cyprinoid fishes have been introduced into Thailand, mostly by Chinese and from China. These have been brought in the young stages in vessels from Hong Kong and Swatow and have been grown in artificial ponds or in fenced-off sections of canals, mostly in Bangkok. Some of the fishes have from time to time escaped from captivity and gained access to open waters, and in the future they will doubtless have to be reckoned with as a regular element of the local fauna. Such escaped fishes have been taken in the Menam Chao Phya as far north as Paknampo, and there is nothing to prevent their ultimate dispersal all over Central Thailand.

The business of transplanting food fishes from China to Thailand has depended on the ease with which certain kinds may be transported, their ready susceptibility to growth in ponds, and the ready sale among the large Chinese population of particular fishes with which the Chinese were familiar at home.

Following is a list of exotic cyprinoid fishes that have been taken to Thailand and successfully acclimatized in ponds; introduction of various other species may be expected from time to time:

Cyprinus carpio Linnaeus. Common carp.
Carassius auratus (Linnaeus). Goldfish.
Aristichthys nobilis (Richardson).
Cirrhinus molitorella (Cuvier and Valenciennes).

Hypophthalmichthys molitrix (Cuvier and Valenciennes).
Ctenopharyngodon idellus (Cuvier and Valenciennes).
Mylopharyngodon aetiops (Basilewsky).

VERNACULAR NAMES

The vast majority of the fresh-water fishes of Thailand have distinctive vernacular names, some of which have borne the test of centuries of use. Many of these names are very apt and clever and suggest either a delightful imagination on the part of the early fishermen or an acquaintance with the structure and habits of given species.

Without implying the attachment of undue importance to colloquial fish names, it is the intention to record in this catalog these names in Roman characters and to indicate their English significance or meaning whenever possible. It should be understood, however, that the exact transcription of Thai words into Roman characters is not possible without the employment of many diacritical marks, whose use and explanation would lead us too far afield for present purposes.

With rare exceptions, the name of a fish in Thai usage is preceded by the word *pla* (fish). Most names consist of a simple word which may be a noun, an adjective, or a participle; thus, *pla mu*, hogfish; *pla deng*, redfish; *pla duk*, wrigglingfish. Qualifying words follow the regular names; thus *pla mu khao*, white hogfish; *pla deng tale*, sea redfish; *pla duk uey*, fat wrigglingfish.

Among the few vernacular names in which the prefix *pla* is not used may be mentioned *ma nam*, or waterhorse, applied to both the seahorse (*Hippocampus*) and to a certain fresh-water pipefish (*Ichthyocampus*). The syllable *ma* in this name, pronounced with a high-pitched tone and meaning horse, must be distinguished from the *ma* in *pla lin ma*, a general name for soles (*Synaptura* and *Cynoglossus*) in which *ma*, pronounced with a rising inflection, means dog, the full name being translated as dog-tonguefish. This colloquial term, originating in Asiatic jungles, is essentially the same as hound-tongue used in western Europe for *Cynoglossus*, and both are the equivalent of the ancient Greek designation for a similar fish that has been perpetuated in the generic name.

As an example of fantastic fish names, there may be mentioned *pla jim fan jorake*, given to a large fresh-water pipefish; *jim fan* means toothpick, *jorake* means crocodile; so the translation of the name would be crocodile toothpick fish.

Some names are onomatopoeic. Common examples are *pla kot* and *pla uk*, generally applied to various catfishes that when caught emit a sound closely approximated by the names.

In a large number of fish names there is a prefix, *ka*, whose significance has not been satisfactorily explained. That it is not now a fundamental part of the name is suggested by the frequency with which, among certain people in certain districts or for certain species, it is omitted without causing any misunderstanding or confusion as to the fish in question. Among the common fish names having this initial syllable *ka* there may be mentioned *pla kaben* (a ray), *pla kabok* (a mullet), *pla kadi* (an anabantid), *pla kahae*, *pla kamang*, *pla kamao*, *pla kasup* (cyprinoids), *pla kapong* (a bass), *pla kasong* (a serpenthead), *pla kathing* (a spiny-eel), and *pla katung* (a gar). The shortened forms *pla sup*, *pla mang*, *pla thing*, etc., are often heard. It may be noted that the prefix *ka* is not restricted to fishes but is a part of the vernacular names of other animals (*karok*, squirrel, *katai*, rabbit, etc.).

USE OF FRESH-WATER FISHES IN CONTESTS

The Thai people share with the people of other nationalities a keen interest in and love for contests of skill, fleetness, and endurance among the lower animals, whether racing horses, racing dogs, fighting cocks, jumping frogs, fighting crickets, or fighting and wrestling fishes.

The idea of using fishes in matched contests seems to have originated among the Thai, and Thailand is the only country in which fish-fighting may be considered a national sport.

The fishes that in Thailand have for many years been employed as combatants are a cyprinodont (*Aplocheilus panchax*), two anabantids (*Betta splendens* and *Trichopsis vittatus*), and a hemiramph (*Dermogenys pusillus*). Two of these have long been cultivated, and their fighting stamina has been greatly improved by cultivation. In the case of all these species, only the adult males are employed.

The pugnacious disposition of the little halfbeak *Dermogenys* is manifested in an entirely different manner from that of *Betta*. The exhibition of strength and endurance, on which the encounters are decided, can best be described as wrestling; and as the fish had no distinctive English name I ventured in 1923 to suggest that it be called wrestlingfish, a designation that has since been generally used. The Thai name, *pla khem*, or needlefish, in allusion to the long sharp lower jaw, is applied to various other halfbeaks, which, as far as known, do not engage in combats.

ECONOMIC IMPORTANCE OF THE FRESH-WATER FISHES

While the coastal waters of Thailand abound with fishes that support an important industry, yielding large quantities of food for local consumption and export, the fresh-water streams, canals, and lakes also have extensive fisheries, and the fishes of the fresh waters are, in certain respects, of greater importance to the general welfare because they constitute the principal animal food of a large part of the interior population and are essential in maintaining a properly balanced diet.

It is hardly an exaggeration to state that in every household in Thailand some kind of fresh-water fish—whether fresh, dried, or smoked—is eaten every day.

Certain fresh-water fishes are among the staple foods of the country, and are often the only source of animal nitrogenous material consumed by millions of people. Outstanding among these fishes in popularity and in quantity utilized are the serpenthead *Ophicephalus striatus*, the anabantids *Trichogaster pectoralis* and *Anabas testudineus;* the catfishes *Clarias*, *Krytopterus*, *Mystus*, and *Pangasius*, and the featherback *Notopterus notopterus.*

The solicitude of the government regarding the perpetuation of the supply of interior fishes is keen. With the killing of other animals coming within the interdiction of the national religion, Buddhism. there is nothing to replace the fishes as sources of nitrogenous food.

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[3] Dr. Stejneger died on February 28, 1943.—EDITOR.

Class PISCES

Subclass ELASMOBRANCHII

Order EUSELACHII: Sharks

Family CARCHARINIDAE

Genus SCOLIODON Müller and Henle

Scoliodon MÜLLER and HENLE, Sitz. Ber. Akad. Wiss. Berlin, 1837, p. 114. (Type, *Carcharias* (*Scoliodon*) *laticaudus* Müller and Henle.)

SCOLIODON WALBEEHMII (Bleeker)

Carcharias (*Scoliodon*) *walbeehmii* BLEEKER 1856 (144), p. (348) 353 (Rio, Bintang Island).
Scoliodon walbeehmi HORA, 1924a, p. 464 (Tale Sap).

Of the numerous species of sharks of various families and genera inhabiting the coasts of Thailand, only one, the present form, has been definitely identified as regularly entering fresh water. This small shark, of wide range (China to India), does not appear to have been recognized or recorded as elsewhere frequenting fresh water.

Reaching a length of 60 to 75 cm. in local waters, this fish is fairly common in the inner lake of the Tale Sap and in the Patalung River, which flows into it.

According to the local fishermen, this shark takes a rather heavy toll of young turtles (*Batagur baska*) from the nesting colony in the Tale Sap near Pak Bhayoon.

Another shark of this genus, *Scoliodon sarrakowah* (Cuvier), and *Hemiscyllium griseum* (Müller and Henle) belonging in the family Hemiscylliidae, are listed by Fowler (1935a, 1937) from Bangkok, but these records are believed to be from market specimens from the Gulf of Siam.

The vernacular Thai name for this and other sharks is *pla chalam.*

Order BATOIDEI: Sawfishes, Rays, and Skates

Family PRISTIDAE: Sawfishes

The sawfishes are common in the shore waters, estuaries, and lower courses of rivers and are caught in considerable numbers in nets and on hooks. They have economic importance in that the flesh meets with ready sale, oil is extracted from the liver, and the fins are dried for the Chinese trade; both flesh and fins are locally regarded as better than those of sharks.

In Thailand as in India the saws of sawfishes are favorite votive offerings from the fishermen to the temples and shrines. Practically every one of the numerous shrines in the coastal districts has a collection of saws of all sizes. Some of the large sawfishes that have been taken in local waters are represented by their saws preserved in the temples.

The Thai vernacular name for the sawfishes is *chanark*.

Genus PRISTIS Linck

Pristis Linck, Mag. Phys. Naturg. Gotha, ser. 3, vol. 6, p. 31, 1790. (Type, *Squalus pristis* Linnaeus.)

Three or four species of sawfishes of the genus *Pristis* are known from Thai waters. Of these, two regularly ascend fresh-water streams and may be found many miles from the sea. These may be identified by the following characters:

1*a*. Origin of dorsal fin behind base of ventrals; under part of caudal with a prominent lobe; rostrum comparatively narrow and slender, tapering very gradually or of approximately same width throughout, with 23 to 35 pairs of teeth, first pair inserted about 3 times width of rostrum in front of eyes---cuspidatus

1*b*. Origin of dorsal fin in advance of ventrals; under part of caudal fin with an inconspicuous lobe; rostrum broader and more tapering, with 17 to 20 pairs of teeth, first pair inserted about 2 times width of rostrum in front of eyes---microdon

PRISTIS CUSPIDATUS Latham

Pristis cuspidatus Latham, 1794, p. 279, pl. 26, fig. 3 (locality not given).

This species of India, Malaya, the East Indies, and Thailand is common in the coastal waters of Thailand and pushes its way far up some of the large rivers. It reaches a large size and is a very formidable creature to handle either in a boat or on shore. There is a record for the Tachin River in Central Thailand of a fish 8 meters long with a saw 2.5 meters long and 40 cm. wide at its base.

PRISTIS MICRODON Latham

Pristis microdon Latham, 1794, p. 280, pl. 26, fig. 4 (locality not given).
Pristis perrottetei Hora, 1923b, p. 144 (Nontaburi) (footnote by Malcolm Smith).

For this species of wide Oriental distribution there is a definite record of the capture of one fish 120 cm. long in the Menam Chao Phya at Nontaburi, 62 km. from the sea. There are various records of examples taken in the river below Bangkok and in the lower parts of other rivers. A fish entangled in a net in the Menam Chao Phya above

Paknam in 1901 was 6 meters long and so unwieldy that it could not be taken into the fishermen's boat; its saw, deposited in a local joss house and examined in July 1923, was 118 cm. long from the basal pair of teeth and 25 cm. broad; the teeth numbered 18 on each side, and the largest were 6 cm. long.

In the Mahanuddee River in India this fish, according to Day, ascends at least 40 miles from the sea, far beyond the influence of the tides and salt water.

Family DASYATIDAE: Stingrays

Genus DASYATIS Rafinesque

Dasyatis Rafinesque, Caratteri animali piante Sicilia, p. 16, 1810. (Type, *Dasyatis ujo* Rafinesque.)

This world-wide genus of stingrays is represented in Thailand by two species that regularly frequent fresh water, besides a number of others found only in salt or brackish water. The general vernacular name for these fishes is *pla kaben*, sometimes contracted to *pla ben*, the different species being distinguished by qualifying adjectives.

1*a*. Tail with a long, deep cutaneous fold on its ventral surface, none on dorsal surface; 5 long papillae inside mouth on lower jaw; disk broader than long, its anterior angle obtuse ---------- sephen

1*b*. Tail without a cutaneous fold on either ventral or dorsal surface; 2 papillae inside mouth on lower jaw; disk longer than broad, its anterior angle acute ---------- bleekeri

Various other rays listed by Fowler (1935a, 1937) from Bangkok and Paknam are regarded as market specimens caught in the Gulf of Siam and therefore excluded from the scope of this catalog.

DASYATIS SEPHEN (Forskål)

Raja sephen Forskål, 1775, pp. viii, 17 (Djedda, Lohaja, Red Sea).

This well-known stingray of the Indian Ocean and Indo-Australian Archipelago is common on the coasts of Thailand and occurs regularly in fresh water. It is found up the Menam Chao Phya for at least 20 miles above Bangkok. In the inner lake of the Tale Sap it is quite common at times and produces young in the strictly fresh waters of that "inland sea." Two specimens collected on July 5, 1929, were a male 71.5 cm. long with disk 18.5 cm. wide and a female 73 cm. long with disk 20 cm. wide, which were born under observation from a fish 59 cm. broad, 52 cm. long to base of tail, and 118 cm. in total length; the young emerged tail first closely rolled on their long axis.

This ray attains a large size in the local salt waters. One measured at Chumporn on the Gulf of Siam, September 25, 1923, weighed 61 kilograms and was 252 cm. in total length, with the body 109 cm. long and 142.5 cm. wide and the tail 143 cm. long. Another brought to the Chumporn market a short time before weighed 240 kilograms and was said to measure over 4 meters across the disk.

In allusion to the large black fin in the middle of the tail, the Siamese fishermen call this ray *pla kaben tong* (*tong*=flag) to distinguish it from other rays in which there is no caudal fin.

DASYATIS BLEEKERI (Blyth)

PLATE 1

Trygon bleekeri BLYTH, 1860a, p. 41 (Bengal).—HORA, 1924a, p. 464 (Tale Sap).
Dasybatus bleekeri HORA, 1923b, p. 173 (Nontaburi).

This marine species of India and Burma, described from Bengal in 1860, was added to the Thai fauna by Hora in 1923 and 1924 and has since been found as far inland as the mouth of the Menam Nan near Paknampo. With the exception of a specimen from the more or less brackish water of the outer lake of the Tale Sap, collected by Annandale in 1916 and reported on by Hora in 1924, all the specimens from Thailand have come from strictly fresh water. Three specimens taken in the lower Menam Nan on October 17, 1930, had the disk 16.8, 19.3, and 20 cm. long, and the tail 65, 76, and 78 cm. long.

In the Bangkok region this fish is known to the fishermen as *pla kaben* and *pla kaben khao*, while in the Paknampo district it is called *pla kaben nam chuet* (fresh-water ray fish).

Subclass TELEOSTOMI

Order ISOSPONDYLI

Family ELOPIDAE: Tarpons, Bigeyes, Bonefishes

Genus MEGALOPS Lacepède

Megalops LACEPÈDE, Histoire naturelle des poissons, vol. 5, p. 289, 1803. (Type, *Megalops filamentosus* Lacepède=*Clupea cyprinoides* Broussonet.)

MEGALOPS CYPRINOIDES (Broussonet)

Clupea cyprinoides BROUSSONET, 1782 (no pagination), pl. 9 (oceans between the Tropics [not Jamaica and Antigua or Rio Janeiro, Brazil]; Tanna Island, South Pacific).
Megalops cyprinoides HORA, 1923b, p. 175 (Nontaburi); 1924a, p. 479 (Tale Sap).—SMITH, 1930, p. 56 (Siam).

This fish, the Oriental correspondent of the celebrated tarpon of the western Atlantic (*Tarpon atlanticus*), has a very wide distribution in the Pacific and Indian Oceans.

While primarily marine, it regularly enters fresh water and in Thailand may be looked for in the lower courses of all large streams. It ascends the Menam Chao Phya for some distance above Nontaburi. In the Chantabun River it is found at least as far upstream as the town of Chantabun. It enters the inner lake of the Tale Sap. Its adaptability to a strictly fresh-water habitat is shown by the fact that in the interior of Java it is reared in fresh-water ponds from young caught along the coast. During 2 years the fish was found on Koh Tao, the isolated island in the Gulf of Siam off Chumporn, which has little or no fresh water except during the rainy season; on July 19, 1927, Dr. A. F. G. Kerr collected specimens 10 to 11 cm. long in an isolated pool in an otherwise dry stream bed cut off from the sea by a high sand bank; and in September 1928 in a similar pool in the same place the present writer found the fish to be common in two sizes, averaging about 10 and 20 cm. long.

A length in excess of 50 cm. is attained by this species, but the largest examples actually met with in Thailand have been about 35 cm. long.

The vernacular designation of this fish in Thailand is *pla taluerk* (upturned-eye fish), a name that does not indicate much discrimination, for the same name is applied to various clupeids, such as *Ilisha*, belonging in another family. In the Chantabun district of Southeastern Thailand, however, this fish is called *pla taluerk nam chuet* (*nam chuet*, fresh water) to distinguish it from the marine species of somewhat similar appearance, with large eyes.

Family CLUPEIDAE: Herrings, Sardines, Shads

This very large and commercially important family has many local species, most of them marine but a few either regular migrants into fresh water or wanderers therein at certain times. The Thai forms having a fresh water habitat may be conveniently considered by subfamilies, which are distinguishable as follows:

1*a*. Mouth terminal or superior, toothed or edentulous; maxillary with 2 supplementary bones.
  2*a*. Ventral fins well developed; anal fin of moderate length, with 15 to 25 rays; jaws equal-- Clupeinae
  2*b*. Ventral fins small or absent; anal fin long, with 33 to 92 rays; lower jaw projecting and upturned------------------------------ Pristigasterinae
1*b*. Mouth inferior, edentulous; maxillary with 1 supplementary bone. Dorosomatinae

Subfamily CLUPEINAE

This subfamily is numerously represented in Thai waters and is economically the most important division of the clupeid fishes. The three local genera that enter fresh water may be distinguished as follows:

1*a*. A distinct notch in middle of upper jaw formed by intermaxillaries meeting at an acute angle; size large; anadromous------- ---------------- Hilsa

1*b*. No distinct notch in middle of upper jaws; size medium; not anadromous.
  2*a*. Scales marked by transverse grooves that are in pairs and are deficient medianly; last 2 anal rays enlarged; lower jaw not markedly prominent ---------- Sardinella
  2*b*. Scales marked by transverse grooves that are not in pairs and are continuous across middle of scale; last 2 anal rays not enlarged; lower jaw more prominent ---------- Harengula

Genus HILSA Regan

Hilsa REGAN, Ann. Mag. Nat. Hist., ser. 8, vol. 19, p. 303, 1917. (Type, *Paralosa durbanensis* Regan.)

HILSA TOLI (Cuvier and Valenciennes)

Alausa toli CUVIER and VALENCIENNES, 1847, vol. 20, p. 435 (Coromandel, Pondicherry).
Clupea (*Alausa*) *toli* VON MARTENS, 1876, p. 405 (Bangkok).
Culpea (*Alosa*) *toli* WEBER and DE BEAUFORT, 1913, vol. 2, p. 64 (Siam).
Hilsa toli HORA, 1923b, p. 174 (Nontaburi).

From the East Indies the range of this species extends to Malaya, Thailand, and India.

In Thailand interest in this fish arises from the fact that it is typically anadromous, like the closely related hilsa (*Hilsa ilisha* (Hamilton)) of India and the shad (*Alosa sapidissima*) of the Atlantic coast of North America. The most noteworthy run is in the Menam Chao Phya. Fish usually begin to arrive every year late in November and slowly ascend the flooded river as far as Pakret and Koh Yai. Some years no fish are observed until the first or second week in December.

There is considerable variation in the size of the fish as they run up the Menam Chao Phya at the spawning time. The males, which average smaller than the females and never reach the size of the largest females, range from 27 to 40 cm. in total length for a large number examined. The females have been 39 to 58 cm. long. For all examples measured during several years, the average length of males was 34.8 cm. and of females 46.7 cm., all these being fully adult fish that had gone into fresh water to spawn.

When the fish first come in from the sea their sexual organs are in an undeveloped condition. Ripening ensues rapidly in fresh water, and spawning takes place in January and February. The favorite spawning ground is the west channel of the river at Pakret. By the end of February all fish have spawned. Spent fish, very pale and somewhat emaciated, gradually work their way downstream, swimming rather deep and being rarely caught in the pongpang (bag) nets, which are set near the surface and are kept distended by the outflowing current.

A special gill-net fishery is conducted for this fish from the village of Ban Po, a part of Bangkok. In an ordinary season there are 30 boats engaged, each with a crew of 2 or 3 men or women. The nets are of peculiar construction, and their operation takes advantage of the observed habits of the fish. The nets, adapted for drifting, are 120 meters long and 7.5 meters (73 meshes) deep, with a mesh of 5 cm. square. They are set at a depth of 2.5 meters and are kept in an upright position by wooden floats attached to the top rope. At intervals of 6 to 7 meters there is a hollow piece of bamboo, painted white, one end of which is attached by a single cord to the top rope of the net. The nets are set during slack tide, whether flood or ebb. When a fish is caught its struggles are reflected in the movements of the adjacent bamboo markers, which may take a vertical position and are conspicuous in the turbid water. The fishermen in the attendant boat draw in the proper section of the net and remove the fish without disturbing the net as a whole.

Fishing is done daily for about 3 months (November to February), and the average daily catch for all boats at Bangkok is about 100 fish. The fish are in good demand on account of their fine flavor and are often sold on the river while the fishery is in progress, so that few may reach the city markets. Fishermen's prices are 1 to 2 bahts per fish.

As an example of the activity of the fishery, there may be presented the record of a visit made to 15 boats operating along the Bangkok water front during the period between 10:30 and 12 o'clock a. m. on February 9, 1926. Six of the boats had no fish, but several of these had already sold their catches to eager customers who came out in boats. The catch of each of the 9 other boats was: 5 females; 4 females, 1 male; 3 females, 2 males; 5 females (one 54 cm. long); 4 females (one ripe[4]), 1 male; 3 females (one 43 cm. ripe, one 53 cm.); 3 females (one 39 cm. ripe), 2 males (35 and 40 cm.); 4 females; 3 females (one ripe).

The following data are for 10 examples of *Hilsa toli* collected from gill-nets on the spawning grounds at Pakret on January 27, 1924:

Sex	Spawning condition	Length to base of middle caudal rays	Length to tip of upper caudal lobe
		cm	*cm.*
Female	Ripe	49.0	58.0
Female	Unripe, ovaries large	35.0	41.5
Male	Spent	32.9	39.0
Male	Spent	32.2	38.9
Male	Spent	31.4	37.1
Male	Spent	31.0	37.2
Male	Spent	29.6	35.0
Male	Spent	25.3	30.0
Male	Spent	23.8	28.5
Male	Spent	22.5	27.0

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[4] The term "ripe" means that the eggs were fully mature and that the female had freely running eggs when alive and was ready to spawn.—L. P. S.

The female 58 cm. long referred to in the foregoing table had freely running eggs. Over a pint of eggs were expressed, and a large part of each ovary was still intact as shown by subsequent dissection. The eggs as extruded were 0.66 mm. in diameter; after water-hardening they were approximately 1 mm. Some of the eggs were artificially fertilized. In view of the facility with which eggs may be taken and hatched, the operation of a field hatchery at Pakret would be entirely practicable as well as desirable.

Another spawning ground of some importance may be the Tale Sap, where Annandale reported the fish abundant in the outer lake in February.

Fishes may be taken in the Gulf of Siam during most of the year, and it seems probable that fishes that come into being in the local waters do not, in the course of growth, wander far from the great shallow arm of the sea that laves most of the coast of Thailand. There are records of fully adult fishes caught in bag nets off the Chantabun Estuary in March, in traps at the head of the Gulf of Siam in July, and in shore seines off Singora in October. As bearing on the age of the fishes at spawning, a single observation may be offered. Scales from a female 46 cm. long taken in the Menam Chao Phya in February were examined by the late Dr. Nicholas Borodin, who had been making studies of the scales of the American shad (*Alosa sapidissima*) for age determination. He pronounced the scales to have come from a fish 5 years old, and noted that a 5-year-old American shad would have an average length of 39 to 42 cm.

The vernacular name for this fish is *pla talum puk*. A sandy spit in the Gulf of Siam off Nakon Sritamarat bears the name Lem Pla Talum Puk on the charts.

Another species of this genus, *H. kanagurta* (Bleeker), which inhabits the coastal waters of the East Indies, Ceylon, India, and East Africa, is fairly common in the Gulf of Siam but does not have the habit of ascending streams; it is distinguishable from *H. toli* by its small size (not exceeding 22 cm.), its more numerous gill rakers (100 to 150 on lower arm of first arch as against 70 to 95 in *toli*), and its shorter caudal fin (about equal to length of head, while in *toli* this fin is 1.5 times the head). The fishermen give this species the distinctive name of *pla mong kroi* or *pla lin kroi*.

Genus SARDINELLA Cuvier and Valenciennes

Sardinella Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 20, p. 28, 1847. (Type, *Sardinella aurita* Cuvier and Valenciennes.)

This world-wide genus of numerous sardinelike fishes has a number of representatives in the coastal waters of Thailand, and two of those species are entitled to notice herein because at times they wander into fresh water. They may be differentiated as follows:

1*a*. Caudal lobes with distinct black tips; gill rakers on lower arm of first arch 38 to 44 ---------- melanura
1*b*. Caudal lobes without distinct black tips; gill rakers on lower arm of first arch 50 to 55 ---------- gibbosa

SARDINELLA MELANURA (Cuvier)

Clupea melanura Cuvier, 1829, p. 318 (locality not given).

Of wide distribution in the East Indies and the Indian Ocean, this species seems to be entitled to notice herein because of the existence in the British Museum of a specimen from the Menam Chao Phya, a gift from the old Siamese Museum.

The species has been sadly confused with *Harengula vittata* (q. v.) and is variously called *Harengula melanurus* and *Clupea* (*Harengula*) *atricauda* by Bleeker, *Clupea atricauda* by Günther, *Harengula commersoni* by Jordan and Seale, and *Clupea* (*Harengula*) *atricauda* by Weber and de Beaufort. The writer follows Regan (1917, p. 384) in identifying this fish with *Clupea melanura* Cuvier (1829) but not with *Alausa melanura* Cuvier and Valenciennes (1847, vol. 20). From *Harengula vittata* it may be distinguished by the generic characters shown in the key and by the more posterior position of the ventral fins, which are inserted under the middle of the dorsal in *melanura* and under or very slightly posterior to the origin of the dorsal in *vittata*. In both forms the terminal part of each caudal lobe is sharply marked off with black.

SARDINELLA GIBBOSA (Bleeker)

Clupea gibbosa Bleeker, 1849 (10), p. (69), 72 (Macassar).
Clupea (*Harengula*) *fimbriata* Weber and de Beaufort, 1913, vol. 2, p. 75, figs. 26, 27 (in part).
Sardinella gibbosa Regan, 1917, p. 383 (Siam).

Although this is almost exclusively a marine species throughout its wide range in the Indo-Australian Archipelago, in the Gulf of Siam, and on the coasts of India and East Africa, in Thailand it has been found in fresh water on a number of occasions. Specimens from the Tapi River near Bandon, Peninsular Thailand, in September 1923, were 9.5 to 10.5 cm. long. Five specimens from the Menam Chao Phya at Paklat in February 1928 were 12.2 to 13.2 cm. long and all had large isopods attached on the abdomen just behind the pectoral fins and on the caudal peduncle, making ulcers.

A length of 17 or 18 cm. is attained by this species. This species occurs in abundance in the Gulf of Siam and is of great potential value because of its suitability for canning as "sardines."

The local vernacular name is *pla lang keo* (green-back fish).

Genus HARENGULA Cuvier and Valenciennes

Harengula Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 20, p. 201, 1847. (Type, *Harengula latulus* Cuvier and Valenciennes=*Clupea macropthalma* Ranzani.)

HARENGULA VITTATA (Cuvier and Valenciennes)

Clupeonia vittata Cuvier and Valenciennes, 1847, vol. 10, p. 352 (Vanikoro).
Clupea (*Alausa*) *melanura* von Martens, 1876, p. 405 (Bangkok).
Clupea (*Harengula*) *melanura* Weber and de Beaufort, 1913, vol. 2, p. 72 (Siam). (*Fide* Regan.)

This widely dispersed species of the Indian and western Pacific Oceans is almost exclusively marine, but in Thailand it has at times a fresh-water habitat. In addition to the record for Bangkok by von Martens, which may be based on market material from the Gulf of Siam, but is not so indicated as are citations for other species, the fish is known from the Tapi River near Bandon in Peninsular Siam, where specimens about 9 cm. long were taken in September 1923. A length of 14 cm. is given by Bleeker for the East Indies.

The species is strikingly marked by having the outer third of each caudal lobe black, thus resembling *Sardinella melanura* (Cuvier).

Subfamily PRISTIGASTERINAE

In this subfamily there are two genera of which representatives in Thailand have the tendency, if not the regular habit, of entering fresh waters from the sea or estuaries. They may be distinguished as follows:

1*a*. Dorsal and ventral fins present; anal rays 33 to 54________________ **Ilisha**
1*b*. Dorsal fin present, ventral fins absent; anal rays 56 to 66______ **Opisthopterus**

Genus ILISHA (Gray) Richardson

Ilisha (Gray) Richardson, Report on the ichthyology of China and Japan, p. 306, 1846. (Type, *Ilisha abnormis* (Gray) Richardson.)

The name *Ilisha*, credited to Gray by Richardson in 1846 on the basis of a drawing of *Ilisha abnormis*, appears to take precedence over *Pellona* of Cuvier and Valenciennes (1847). There are many species now known from Thai waters, but most of them have not been ascertained to enter fresh water at any time, although there is a tendency on the part of the genus as a whole to come within the influence of brackish water in estuaries and at the mouths of rivers. One Burmese species ascends the Irrawaddy as far as Mandalay.

In addition to the species differentiated in the key below, definitely credited with a temporary fresh-water habitat, Fowler (1934a, 1935a) lists several species (*I. indica* Bleeker and *I. brachysoma* Bleeker) as collected at Bangkok; these citations, however, cannot be accepted as constituting undoubted fresh-water records and are believed to be based on market specimens from the Gulf of Siam.

1*a*. Abdominal scutes 25 or 26, of which 7 are posterior to base of ventrals; anal origin under posterior half of base of dorsal; origin of dorsal fin somewhat nearer to tip of snout than to base of caudal------------------- kampeni

1*b*. Abdominal scutes 28 to 31, of which 9 to 11 are posterior to base of ventrals; anal origin under hindermost rays of dorsal; origin of dorsal fin midway between tip of snout and base of caudal-------------------- dussumieri

ILISHA KAMPENI (Weber and de Beaufort)

Pellona kampeni WEBER and DE BEAUFORT, 1913, vol. 2, p. 87 (Batavia, Java; Balikpapan, Borneo).

Otherwise known only from Borneo and Java, this species is entitled to a place in this catalog from having been taken at two fresh-water localities in Peninsular Thailand, the Tapi River near Bandon in September 1923, and the inner lake of the Tale Sap at Pak Bhayoon in October 1923. The specimens agree closely with the original description of Weber and de Beaufort.

The largest is 17 cm. long.

ILISHA DUSSUMIERI (Cuvier and Valenciennes)

Pellona dussumieri CUVIER and VALENCIENNES, 1847, vol. 20, p. 316 (Malabar; Coromandel; Bombay).

This is a common species of the East Indies and Thailand, primarily marine but haunting the mouths of rivers and sometimes ascending streams, probably for spawning purposes. On June 10, 1926, fishes approaching the spawning condition entered the estuary of the Chantabun River and were caught in set nets, and the next day many were taken in the lower river and sold in Chantabun, over 200 being observed in the market.

The largest examples were 46 cm. long, many 28 to 37 cm.

In the Chantabun district, where this fish is well known to fishermen and marketmen, it is called *pla lek*. Elsewhere around the shores of the Gulf of Siam the vernacular name is *pla taluerk*, shared with various other species.

Genus OPISTHOPTERUS Gill

Opisthopterus GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 38. (Type, *Pristigaster tartoor* Cuvier and Valenciennes.)

OPISTHOPTERUS MACROGNATHUS Bleeker

Opisthopterus macrognathus BLEEKER, 1866 (381), p. 299 (Sumatra and Borneo).

Although long known from Singapore, Sumatra, Borneo, and Java, in sea and estuaries, this well-marked species has rarely been recorded in localities outside the Indo-Australian Archipelago. It is, however, not uncommon in Thai waters, and many examples were examined and a number of specimens preserved from points about the head of the Gulf of Siam. It is to be found chiefly in salt water, but it enters estuaries, such as the Chantabun Estuary in Southeastern Thailand, and shows a tendency to venture short distances up streams like the Bangpakong and the Menam Chao Phya.

It reaches a length of 20 cm., but owing to its boniness and limited amount of muscular tissue it has little food value.

This species is known to the fishermen as *pla bang* (compressed fish), *pla bai mai* (bamboo-leaf fish), and *pla iput*, a name sometimes shared with *Pellona.*

Subfamily DOROSOMATINAE: Gizzard Shads; Mud Shads

This subfamily is given full family rank by Jordan (1923). There are two local genera, distinguished as follows:

1*a*. Last dorsal ray produced as a filament, which reaches caudal fin; maxillary with its posterior end expanded and curved downward; gill rakers very numerous (about 140) ---------- **Nematalosa**

1*b*. Last dorsal ray not produced as a filament; maxillary with its posterior end straight and tapering, its median part expanded; gill rakers less numerous (about 80) ---------- **Anodontostoma**

These fishes in Thailand, like their close relatives (*Dorosoma* of Rafinesque) in the Atlantic, are migratory, primarily marine but entering fresh or brackish waters to spawn. They subsist chiefly on minute organic objects or particles obtained in bottom mud, which is strained by their numerous fine gill rakers. Digestion is facilitated by a long convoluted intestine beset with fingerlike villi and supplemented by caeca, which pour juices into the intestine; and by a thick-walled stomach like the gizzard of a fowl.

Genus NEMATALOSA Regan

Nematalosa REGAN, Ann. Mag. Nat. Hist., ser. 8, vol. 19, p. 313, 1917. (Type, *Clupea nasus* Bloch.)

NEMATALOSA NASUS (Bloch)

Clupea nasus BLOCH, 1795, vol. 9, p. 116, pl. 429, fig. 1 (Malabar).

This species of the Indo-Australian Archipelago and India occurs throughout the Gulf of Siam and ascends streams for short distances. There are no published references to its occurrence in the fresh waters of Thailand, but it has been observed in such situations on various occasions. A favorite resort and spawning ground is the Tale Sap, where, in the inner lake, it has been found in July and October. Fish of both sexes with sexual organs in an advanced stage of development but not in actual spawning condition were collected in October.

Adult fish are 15 to 20 cm. long.

The local fishermen call the fish *pla kōk* or *pla koak*, sometimes, in the Tale Sap, *pla kup*.

Genus ANODONTOSTOMA Bleeker

Anodontostoma Bleeker (16), Verh. Batav. Genootsch. (Madura), vol. 22, p. 15, 1849. (Type, *Anodontostoma hasseltii* Bleeker=*Clupanodon chacunda* Hamilton.)

ANODONTOSTOMA CHACUNDA (Hamilton)

Clupanodon chacunda Hamilton, 1822, pp. 246, 383 (Gangetic estuaries).
Dorosoma chacunda Weber and de Beaufort, 1913, vol. 2, p. 25, fig. 14 (Siam).

Nearly all the observed occurrences of this species in Thailand apply to the Gulf of Siam off the mouths of rivers. There are, however, a few definite records for fresh water, such as the Chantabun River at the town of Chantabun. Specimens from the Menam Chao Phya are in the British Museum by gift of the old Siamese Museum long since disbanded as a repository for natural-history specimens. Specimens, 15 to 16 cm. long, approaching the spawning condition and doubtless destined for the lower reaches of the river have been taken off the Menam Chao Phya in December. Young of the year, 6 to 6.75 cm. long, have been caught at the head of the Gulf of Siam in July.

Although very bony, the flesh is considered of good flavor, and in the commercial fisheries of the Gulf of Siam large quantities are sometimes caught and are preserved by sun-drying with or without previous pickling.

The fishermen do not distinguish this species from *Nematalosa nasus* (Bloch) and give it the same name, *pla kōk*.

Family ENGRAULIDAE: Anchovies

Most of the Thai members of this large and important family are marine. There are, however, species in four genera that regularly enter fresh water and are entitled to a place in this catalog. They may be differentiated as follows:

1*a*. Caudal fin small, pointed, not forked, and joined to the very long anal fin; tail strongly tapering; upper rays of pectoral fins detached and filamentous -- Coilia
1*b*. Caudal fin large, forked, and entirely separate from the long anal fin; tail not strongly tapering; upper rays of pectoral fins not detached.
  2*a*. Uppermost ray of pectoral fins more or less produced into a filament but not detached from other rays; origin of anal fin anterior or posterior to origin of dorsal fin; spiniferous ventral scutes from head to anal opening -- Setipinna
  2*b*. Uppermost ray of pectoral fins not produced into a filament.
    3*a*. Origin of anal fin anterior to origin of dorsal; no free predorsal spine; spiniferous ventral scutes from base of pectorals to anal opening; jaws with canine teeth -- Lycothrissa

3*b*. Origin of anal fin posterior to origin of dorsal; a free predorsal spine; spiniferous ventral scutes from head to anal opening; jaws without canine teeth -- Scutengraulis

Genus COILIA Gray

Coilia Gray, Zoological Miscellany, pt. 1, p. 9, 1831. (Type, *Coilia hamiltonii* Gray.)

COILIA MACROGNATHOS Bleeker

Coilia macrognathos Bleeker, 1852 (55), p. 436 (Borneo).—von Martens, 1876, p. 404 (Bangkok).—Fowler, 1935a, p. 96, fig. 15 (Bangkok).

Coilia macrognathus Weber and de Beaufort, 1913, vol. 2, p. 49 (Siam).—Hora, 1923b, p. 175 (Nontaburi).

Of the various species of *Coilia* known from Thai waters, this is the only one that seems to ascend the local rivers regularly. It is otherwise known from estuaries in Borneo. It may be found every year, usually in the winter season, in the lower courses of the Menam Chao Phya and the Menam Bangpakong. In the former it exhibits a definite migratory upstream movement, beginning in November and continuing for several months. The fish at that time is in company with the migrating shad, *Hilsa toli* (Cuvier and Valenciennes), and ascends at least as far as Pakret. In the wide-mesh floating gill nets set for shad, the fish is often caught by having its long, backward-projecting toothed upper jaw entangled in the webbing.

The ventral fins are usually inserted just posterior to the origin of the dorsal, but there is variation in Thai specimens in which, as pointed out by Fowler (1935a), the ventrals may be inserted a little in advance of the dorsal. Another variation shown by local examples is in having the teeth on the upper border of the maxillary of uniform size, as shown in Bleeker's plate ((301), vol. 6, pl. 261, fig. 4), and not of alternately different sizes as given by Weber and de Beaufort.

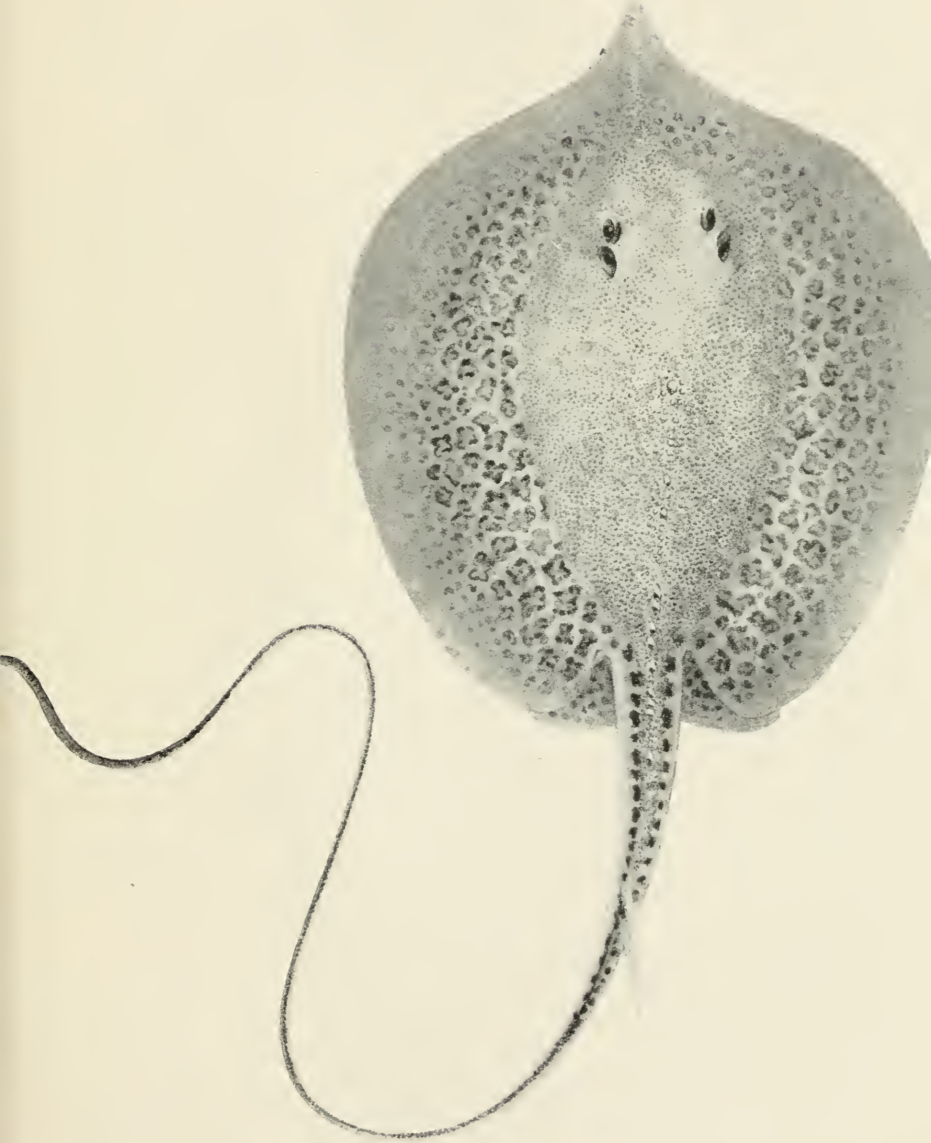
A maximum length of about 25 cm. is reached in Thailand.

The vernacular name for this and other species is *pla hang kai* (chicken-tail fish), in allusion to the fancied resemblance to the trim lines of the fighting cock.

Genus SETIPINNA Swainson

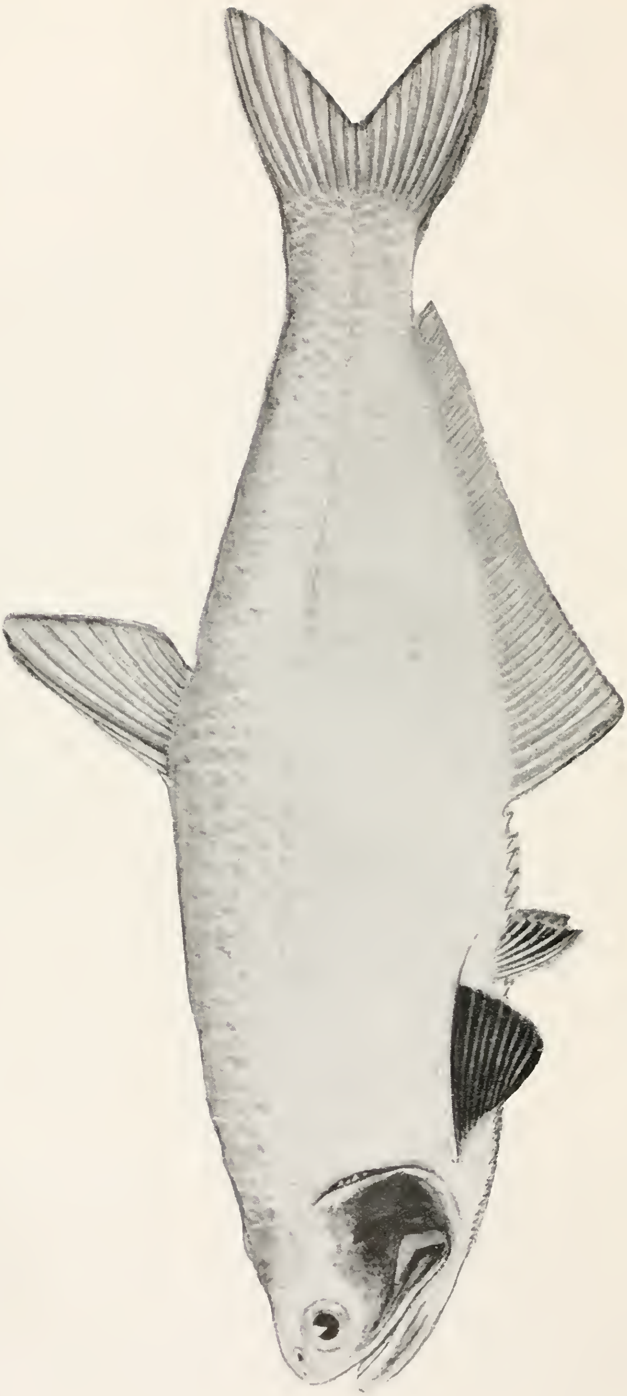
Setipinna Swainson, The natural history of . . . fishes, vol. 2, p. 292, 1839. (Type, *Setipinna megalura* Swainson=*Clupea phasa* Hamilton.)

These anchovies are recognizable at first sight by the moderate or extreme lengthening of the uppermost ray of the pectoral fins. There are two local species, which may be distinguished by characters shown in the key below. They share with the other anchovies the vernacular name of *pla meo* (cat fish).



DASYATIS BLEEKERI (BLYTH).

Drawn by Luang Masya; courtesy of the Thailand Government.



SETIPINNA MELANOCHIR (BLEEKER).

Drawn by Luang Masya; courtesy of the Thailand Government.

1*a*. Scales in lateral line 50 to 53; origin of anal fin in advance of origin of dorsal; dorsal rays i, 10 to i, 14; upper produced ray of pectoral fins reaching end of ventrals; gill rakers on long limb of first arch 9 or 10; pectoral fins often uniformly black ---------- melanochir

1*b*. Scales in lateral line 40 to 48; origin of anal fin posterior to origin of dorsal; dorsal rays i, 13 to i, 15; upper produced ray of pectoral fins very long, sometimes reaching posterior third of anal fin; gill rakers on lower arm of first arch 18; pectoral fins not uniformly or otherwise black -------- taty

SETIPINNA MELANOCHIR (Bleeker)

PLATE 2

Engraulis melanochir BLEEKER, 1849 (16), p. 13 (Madura Strait near Kammal and Surabaja).

Stolephorus melanochir BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).

Setipinna melanochir BLEEKER, 1866–72 (301), vol. 6, p. 136, pl. 267, fig. 3 (Siam).—WEBER and DE BEAUFORT, 1913, vol. 2, p. 28, fig. 15 (Siam).—HORA, 1923b, p. 174 (Nontaburi); 1924a, p. 481 (Tale Sap).

Engraulis melanchoir SAUVAGE, 1883b, p. 151 (Menam Chao Phya).

Outside of the East Indies this species is commonest and best known in Thailand. Of the numerous specimens collected, nearly all have come from strictly fresh water, although in Thailand, as in the East Indies, the fish frequents also salt and brackish waters. In the Menam Chao Phya the fish is found far upstream—at least as far inland as Lopburi. In the Bangpakong and other large streams entering the head of the Gulf of Siam the fish is common at times in their lower courses. A center of noteworthy abundance is the inner lake of the Tale Sap and the Tale Noi, the latter connected with the Tale Sap by short, narrow channels. From July to October during several years the fish was present in these waters.

The maximum size recorded for the East Indies is 27 cm. (Bleeker). The largest example observed in Thailand was 32.5 cm. long. A specimen in the U. S. National Museum from the Bangpakong River, June 26, 1933, is 28.5 cm. long. Examples 18 to 20 cm. long are often met with.

In addition to having a striking physiognomy, this fish is conspicuously colored. When adult, the body is of a uniform pale yellow, there may be black areas on the side of the head, the upper and lower jaws may be black, and the fins except the pectorals are usually pale to bright yellow. The pectorals in the larger examples are often, perhaps usually, jet black, but many fish have no black whatever on the pectorals, which may then be bright yellow and the ventrals may be black-tipped. Exceptionally the black pectorals have the produced ray yellow.

Owing to its rather large size, this fish is frequently sent to the markets in the larger communities and has some reputation as a food article.

SETIPINNA TATY (Cuvier and Valenciennes)

Engraulis taty Cuvier and Valenciennes, 1848, vol. 21, p. 60 (Pondicherry; Malacca).

Stolephorus taty Bleeker, 1865 (356), p. 176 (Siam).

The range of this species extends from the East Indian Archipelago through the Gulf of Siam to both coasts of India. It is much less partial to fresh water than is *S. melanochir*, and the Thai records for streams and lakes are few. There is, however, a definite record for the extreme part of the Tale Sap, October 1923, and the fishes may be commoner in that region than the collected specimens would indicate.

The largest local examples have been 17 cm. long.

Genus LYCOTHRISSA Günther

Lycothrissa Günther, Catalogue of the fishes in the British Museum, vol. 7, p. 399, 1868. (Type, *Engraulis crocodilus* Bleeker.)

LYCOTHRISSA CROCODILUS (Bleeker)

Engraulis crocodilus Bleeker, 1851 (26), p. 15 (Bandjermassing, Borneo).—Sauvage, 1883b, p. 151 (Menam Chao Phya).

Engraulis (*Lycothrissa*) *crocodilus* von Martens, 1876, p. 404 (Bangkok).

Lycothrissa crocodilus Weber and de Beaufort, 1913, vol. 2, p. 31, fig. 16 (Siam).—Fowler, 1935a, p. 96 (Bangkok).

The numerous records for this species, otherwise known only from brackish and fresh waters of Sumatra and Borneo, are entirely for the Menam Chao Phya. It ascends the river at least as far as Koh Yai, and specimens examined have been collected in February, March, and August.

The largest obtained have been over 22 cm. long. A length of 28 cm. is recorded for the East Indies. Full maturity is attained when less than half that size. Thus, a fish taken August 9, 1923, contained well-developed ova.

The species may be readily recognized by the characters indicated in the key, especially the presence in the jaws of caninoid teeth combined with a comparatively short maxillary and the origin of the dorsal fin definitely posterior to the origin of the anal. In full-sized specimens the silvery sheen of the body is relieved by wholly or partly black pectoral fins and a pale yellow caudal fin with a well-defined broad blackish posterior edge.

Among the Thai this fish is always called *pla meo* (cat fish).

Genus SCUTENGRAULIS Jordan and Seale

Scutengraulis JORDAN and SEALE, Copeia, No. 141, p. 30, 1925. (Type, *Thrissa hamiltoni* Gray.)

SCUTENGRAULIS MYSTAX (Bloch)

Cupea mystax BLOCH, *in* Schneider, 1801, p. 426, pl. 83 (Malabar).
Engraulis mystax HORA, 1923b, p. 174 (Nontaburi).

One of the most abundant of the Thai anchovies, caught in immense quantities along all the shores of the Gulf of Siam, this species sometimes enters fresh water, as has been recorded by Hora. Throughout most of its range, extending from China through the Indo-Australian Archipelago to India, it is an important economic fish in the seas and estuaries.

A maximum length of about 20 cm. is attained.

The local vernacular name is *pla meo* (cat fish), in allusion to the resemblance of the long mustache-like maxillary to the whiskers of a cat.

Family OSTEOGLOSSIDAE

Genus SCLEROPAGES Günther

Scleropages GÜNTHER, Ann. Mag. Nat. Hist., ser. 3, vol. 14, p. 196, 1864. (Type, *Scleropages leichardti* Günther.)

SCLEROPAGES FORMOSUS (Müller and Schlegel)

Osteoglossum formosum MÜLLER and SCHLEGEL, 1844, p. 1, pl. 1 (Borneo).
Scleropages formosus SMITH, 1931b, p. 64 (Krat); 1931d, p. 177 (Southeastern Siam).—FOWLER, 1934b, p. 335 (Krat).

Described in 1844, this fish was for a long time supposed to be confined to streams and lakes in Borneo, Bangka, and Sumatra. In 1931 the species was recorded from several localities in Malaya.

In 1931 a Boy Scout in Krat, Southeastern Thailand, first made known the presence of the fish in that country and presented some very interesting notes, which accompanied a specimen 26 cm. long sent to Bangkok. These notes (Smith, 1931d) constitute by far the most extensive observations heretofore made on this species, and it is important that they be confirmed and amplified by a qualified biologist.

The fish is fairly common in streams, canals, and swamps in the Krat region and it is said to attain a length of 90 cm. and a weight of 7.2 kilograms. Many are caught for market with lines, cast nets, gill nets, and other apparatus, and the flesh is of good flavor.

The observations at Krat indicate that the eggs, of large size and few in number, are taken into the mother fish's mouth immediately after extrusion and there incubated, this habit having been reported also by Fuhrmann (1905) and by Boulenger in the East Indies.

The local vernacular name is *pla tapad*, applied to no other species.

Family NOTOPTERIDAE: Featherbacks

Genus NOTOPTERUS Lacepède

Notopterus LACEPÈDE, Histoire naturelle des poissons, vol. 2, p. 189, 1800. (Type, *Notopterus kaipirat* Lacepède=*Gymnotus notopterus* (Pallas).)

The featherbacks are among the most characteristic fishes of Thailand. They are easily recognized by their broad, compressed, finely scaled body; large membranous opercular flap; teeth on jaws, tongue, vomer, palatines, and pterygoids; double-serrated ridge along the median line of the very short abdomen; small tuftlike dorsal fin inserted near the middle of the long back; ribbonlike anal fin with 100 or more rays occupying seven-eighths of the length of the head and body; small caudal fin confluent with the anal; and rudimentary ventral fins.

There may be three species in Thailand. Reports from several places indicate the occurrence of a fish differing in general appearance from the other species; and in Bung Borapet assistants of the Siamese Bureau of Fisheries have observed, but have been unable to secure, fish that did not seem to be either of the local forms and for which the bung fishermen have the name *pla satu*, not applied to any other species. If another species actually occurs, it must be rare and is possibly *Notopterus borneensis* Bleeker, of Borneo and Sumatra.

The two common local species may be distinguished by the following characters:

1*a*. Maxillary extending far behind eye; head and body scales of same size; 12 to 22 transverse rows of scales on preopercle; 37 to 45 pairs of spines along median line of abdomen; a row of 5 to 10 large round black spots above anal fin; size large____chitala

1*b*. Maxillary extending to pupil or to rear border of eye; head scales larger than body scales; 8 to 10 transverse rows of scales on preopercle; 28 to 33 pairs of spines along median line of abdomen; no black spots above anal fin; size medium____notopterus

NOTOPTERUS CHITALA (Hamilton)

FIGURE 1

Mystus chitala HAMILTON, 1822, pp. 236, 382 (Bengal and Bebar Rivers).

Notopterus ocellifer BLEEKER, 1865 (356), p. 176 (Siam).

Notopterus chitala SAUVAGE, 1881, p. 164 (Siam).—WEBER and DE BEAUFORT, 1913, vol. 2, p. 10, fig. 6 (Siam).—HORA, 1923b, p. 175 (Nontaburi).—VIPULYA, 1923, p. 227 (Bangkok, Bangpa-in).—SMITH, 1930, p. 56 (Siam); 1933b, p. 245, pls. 8, 9, fig. 1 (Siam).—FOWLER, 1935a, p. 90 (Bangkok).

In the rivers of Java, Borneo, Sumatra, India, Burma, Malaya, and Thailand this fish is noteworthy for its large size, peculiar form, and interesting habits. In Thailand it abounds in the rivers, canals, and swamps of the central plain and is one of the best-known fishes, always rendering itself conspicuous by its habit of coming to the surface, making a splash, rolling over, and exposing its broad silvery side.

A length of more than a meter is attained in India, the greatest length reported in the Indo-Australian Archipelago is 87.5 cm., and fishes a meter long have very rarely been observed in Thailand in recent years, the size usually being 70 to 75 cm.

Thai examples of *Notopterus chitala* always exhibit a longitudinal series of black spots on the side above the anal fin, each spot often having a well-defined white ring around it. The spots number from 5 to 10 on each side, and there may be a difference of 1 or 2 spots on the two sides of a given fish. This color phase in Siamese fishes is in strong contrast with that observed in fishes in the Indo-Australian Archipelago, which are usually immaculate, although Weber and de Beaufort state that rarely there is a series of 4 or 5 black spots in the caudal region.

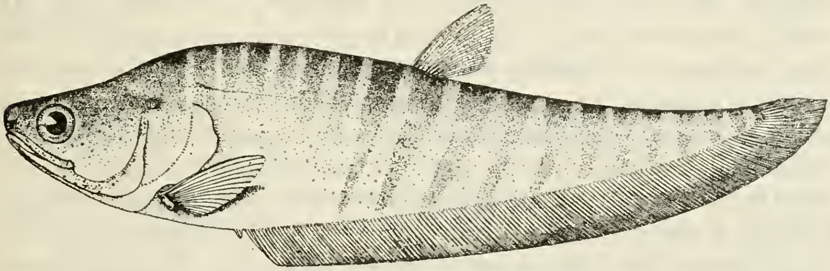


FIGURE 1.—*Notopterus chitala* (Hamilton). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

By the time the young have reached a length of 3 to 3.5 cm., 10 to 15 blackish or dark gray cross bands appear; at a length of 7 to 8 cm., when the fishes are about 70 days old, a dark brown rounded or elliptical spot appears at the lower part of each of the posterior cross bands; with further growth the cross bands begin to grow faint and finally disappear, while the spots become more intense and persist throughout adult life.

Notopterus chitala subsists on insects, shrimps, and especially small surface-swimming fishes, including the halfbeak *Zenarchopterus ectuntio* (Hamilton), the archerfish *Toxotes jaculatrix* (Pallas), and various cyprinoids.

This fish has unique spawning habits, which have been made known chiefly by assistants of the Siamese Bureau of Fisheries. Writing of the notopterid fishes in the Cambridge Natural History, Fishes (1904. p. 555), Dr. Boulenger recorded that "nothing is known of their breeding habits and developments," and Dean's Bibliography of Fishes

(1916–1923) makes no reference to this subject. Thanks to the observations made in Thailand in recent years, the egg-laying habits, eggs, incubation, and development of this species are now rather well known. From an account thereof published by the writer (1933b) the following information is extracted:

The existence, in a single fish, of eggs of several different stages of development has been shown by dissection. It has also been proved that only one ovary develops during one season. Whether the two ovaries alternate in activity from year to year or whether only one ovary ever functions remains to be determined. In numerous specimens the mature ovary was found to occupy the left side of the comparatively small abdominal cavity, the digestive and other viscera being pushed to the right side.

It seems to be fully established that the care of the eggs devolves only on the male fish. Throughout the hatching period the male is in assiduous attendance. Human intruders are fiercely attacked and natural enemies, comprising for the most part small catfishes (*Mystus* of Scopoli) and minnows (*Rasbora* of Bleeker), are driven off. An equally important duty of the male is keeping the eggs aerated and free from sediment by fanning movements of the tail. In the sluggish waters of swamps the eggs may become covered with sediment, which prevents normal development and induces the growth of fungus. If the guardian is removed, the eggs are preyed on by small fishes and those that escape are coated with sediment and ultimately asphyxiated. Fishermen sometimes take advantage of the male's devotion by fishing at a stake or stump that has been found to bear eggs. By jigging with unbaited hooks or using hooks baited with insects, shrimps, or small fish, they sooner or later catch the male parent and sacrifice the incipient brood. The female parent is never observed at the egg posts under circumstances that indicate maternal solicitude.

The number of eggs deposited at one time on one post may be several thousand, and the egg output of one fish in a season may exceed 5,000 and even reach 10,000 or more. In Bung Borapet a four-sided stake taken up for observation on July 17, 1932, was, by actual count, found to have 1,733 eggs on two sides and approximately the same number on the other two sides, a total of more than 3,400. The incubation time, in water with an average temperature of 33° C., is 5 to 6 days.

The Siamese Bureau of Fisheries has encouraged and facilitated egg laying in this species by providing suitable posts. Thus, in May, June, and July 1932 in an outlet of Bung Borapet, 53 round and square posts were driven into the bottom at intervals of several meters in water 1.5 to 2 meters deep; and on 18 days between May 3 and July 30, 36 of the posts were utilized by the fishes, 4 each on June 1 and 8 and 5 on July 2. Some eggs, removed from posts and stumps and placed in troughs, hatched with a mortality of 20 percent owing to sediment and fungus. Thus, while artificial hatching is practicable, it does not seem to be superior to hatching under normal conditions and should probably be resorted to only when batches of eggs have been left without the care of a male fish.

The fish is in considerable demand, and large quantities are caught for market with seines and other apparatus. Swamps yield the largest numbers. As the fish bears transportation rather well, rice barges are sometimes used for sending fish to Bangkok, especially from swamps whose fishing privileges are under private lease. A barge filled with water instead of rice may carry 3,000 or more large fish for several hundred miles.

The flesh is of good flavor but full of small bones. In order to overcome the bones the flesh is often chopped fine and then made into balls and cooked with curry.

The Thai call this fish *pla krai* and *pla hang pan; krai* means to move slowly but naturally, *hang pan* means broad tail. The Bengali colloquial name for the fish is *chitala*, adopted as the specific name by Hamilton.

NOTOPTERUS NOTOPTERUS (Pallas)

Gymnotus notopterus PALLAS, 1769, pt. 7, p. 40, pl. 6, fig. 2 (Indian Ocean).

Notopterus kapirat BLEEKER, 1865 (356), p. 176 (Siam).—PETERS, 1868, p. 273 (Siam).—SAUVAGE, 1881, p. 164 (Siam).—KÁROLL, 1882, p. 184 (Siam).—SAUVAGE, 1883b, p. 152 (Menam Chao Phya).

Notopterus notopterus WEBER and DE BEAUFORT, 1913, vol. 2, p. 9 (Siam).—VIPULYA, 1923, p. 226 (Siam).—HORA, 1923b, p. 175 (Siam); 1924a, p. 482 (Tale Sap).—SMITH, 1930, p. 56 (Siam); 1933b, p. 245, pl. 9, fig. 2 (Siam).—FOWLER, 1934a, p. 85 (Bangkok, Chiengmai); 1934b, p. 335 (Bangkok); 1935a, p. 90 (Bangkok); 1937, p. 130 (Bangkok, Paknam, Tachin); 1939, p. 40 (Huey Yang).

The range of this species includes Java, Sumatra, India, Burma, Malaya, and Thailand. It is generally distributed over Central Thailand, in rivers, swamps, and canals. It is known also from the Tapi River above Bandon and from Klong Sok, an upper tributary of the west branch of that river. Farther south in Peninsular Thailand the fish has been reported from the inner lake of the Tale Sap. In Southeastern Thailand it has been collected in the Chantabun River and in a tributary thereof on Kao Sabap. In Northern Thailand the fish appears to be uncommon; among the few records is one small specimen from the Mengeh, a tributary of the Meping.

While in India this fish may reach a length of 60 cm. or more, many specimens measured in Thailand have been under 40 cm., thus agreeing with the maximum size of 35 cm. given by Bleeker and by Weber and de Beaufort for the Indo-Australian Archipelago. Of a dozen adult fish taken at random from a large catch in a trap at Hang Kraben, Central Thailand, December 11, 1924, the lengths were: One, 24 cm., one, 26 cm., four, 28 cm., one, 29 cm., two, 33 cm., one, 34 cm., one, 35 cm., and one, 38 cm.

In life the adult fish has a nearly uniform silvery gray or light bronze or copper color. Young fishes are marked with narrow dark gray or blackish cross bands of somewhat irregular shape, mostly wider than the interspaces. The bands, numbering 25 to 30, begin on the nape and extend to the base of the caudal fin. The 4 or 5 anterior ones extend from the back across the opercle and are approximately vertical; the others are inclined downward and forward. The bands begin to disappear when the fish are about 10 cm. long, and at a length of 15 cm. only vestiges remain. Occasionally traces of the transverse bands persist, especially anteriorly, in nearly full-grown fishes.

Insects, crustaceans, and succulent roots of aquatic plants constitute the principal food of this species.

At the period of flood water, the adults enter the swamps and deposit eggs on submerged roots of aquatic plants. Observations on egg-laying, incubation, growth, and behavior of young are much less extensive than for *N. chitala.* With the subsiding of the flood waters, the adult and young leave the swamps and enter the rivers and canals in great numbers.

The flesh is sweet but full of small bones. Large quantities are caught for domestic consumption and for sale, and in some places there is at times an active special fishery. In some of the canals extending eastward from the Menam Chao Phya to the Menam Bangpakong, hundreds of large scoop nets (Yokyaw) are operated. The fishes are eaten either fresh or smoked. Their shape adapts them for smoking whole, and after that treatment they are distributed over all parts of the country.

The Siamese name for this fish is *pla chalat* or *pla salat*, meaning clever or cunning fish.

Order OPISTHOMI

Family MASTOCEMBELIDAE: Spiny Eels

The mastocembelids are acanthopterygian fishes of extraordinary aspect, eellike in shape, with minute scales, a pointed snout terminating in a movable fleshy tip, small mouth, minute jaw teeth, small gill openings on the under side of the head, anterior nostrils widely separated from the posterior and contained in a tentacle on the side of the rostral appendage, very long dorsal and anal fins composed partly of strong, short spines, and deficient ventral fins. They resemble the true eels in having the shoulder girdle not suspended from the skull. Authorities have differed as to their systematic position.

Günther (1861, vol. 3, p. 539) placed them between the trumpetfishes (Fistulariidae) and the springbacks (Notacanthidae) and wrote: "The structure of the mouth (not of the bones of the upper jaw) and of the gill-apparatus, the separation of the humeral arch from the skull, the absence of ventral fins, the anatomy of the internal parts, and the whole habit, afforded ample proof that these fishes are eels, in which a part of the dorsal fin is spinous."

Boulenger (1904, p. 716) placed them in the suborder Opisthomi, between the suborder Acanthopterygii and the suborder Pediculati, and stated: "This division stands in the same relation to the Acanthopterygii as do the Apodes to the Malacopterygii. The single family is possibly derived from the Blenniidae."

Jordan (1923) placed them in the order Opisthomi immediately preceding the Apodes.

The family comprises two closely related genera, both represented in Thailand, one by a single species, the other by eight species.

1*a*. Under surface of rostral appendage marked by transverse striae; no spines at angle of preopercle______________________________________ Macrognathus
1*b*. Under surface of rostral appendage without transverse striae; spines at angle of preopercle in most species______________________ Mastocembelus

Genus MACROGNATHUS Lacepède

Macrognathus Lacepède, Histoire naturelle des poissons, vol. 2, p. 283, 1800. (Type, *Ophidium aculeatum* Bloch, restricted by Cuvier and Valenciennes, 1831.)

MACROGNATHUS ACULEATUS (Bloch)

Ophidium aculeatum Bloch, 1787, vol. 5, p. 60, pl. 159, fig. 2 (East Indies).
Rhynchobdella aculcata var. *siamensis* Günther, 1861, vol. 3, p. 540 (Petchaburi).
Rhynchobdella ocellata Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).
Rhynchobdella aculeata von Martens, 1876, p. 396 (Bangkok).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Hora, 1923b, p. 180 (Bangkok).—Chabanaud, 1924, p. 580 (Gulf of Siam).—Fowler, 1934a, p. 146 (Chantabun); 1935a, p. 134 (Bangkok); 1935b, p. 513 (Old Chiengsen); 1937, p. 222 (Bangkok, Tachin, Mepoon, Kemarat).
Rhyncobdella aculeata Sauvage, 1881, p. 160 (Siam, Mekong).

The range of this species extends from India to Burma, Thailand, Indo-China, Malaya, and some of the East Indian islands (Borneo, Moluccas). According to Hora (1923b), the fish "is found in brackish waters within tidal influence and in the deltas of Indian, Burmese and Sind rivers." In Thailand, however, the fish is rare in brackish or coastal waters and is mostly to be met with far from the sea, throughout the Menam Chao Phya, in the Menam Sak as far upstream as Pechabun, in the Menam Chi at Udon, as far inland as Kemarat, and in tributaries of the Menam Mao, and in various lakes, swamps, canals, and ditches of the central plain.

This fish seldom exceeds a length of 30 cm. in Thailand, but in other countries it is reported up to 37 or 38 cm.

Günther (1861) had a specimen from "Pachebore," Thailand, obtained by Mouhot, and called it var. *siamensis*, with the statement: "Having only one specimen, we do not feel that we should be justified in describing it as a separate species." The differences from typical *aculeata*, namely, 13 instead of 18 to 20 dorsal spines, 58 instead of 52 soft anal rays, and a pair of confluent ocelli at the base of the caudal fin, seem to come within the normal variation in the species. Hora's specimen from Bangkok had 15 dorsal spines, and Day gave the dorsal spines as 16 to 20 in Indian examples. The black white-edged ocelli along the base of the dorsal fin number 2 to 9; exceptionally there may be, in addition, one or two ocelli at the base of the caudal fin and more rarely an ocellus at the posterior base of the anal fin (Fowler, 1934a).

The variation in the number and position of the ocelli is well illustrated by fish in the Deignan collection from brooks tributary to the Meong, an affluent of the Mekong, between Wieng Papao and Chiengmai, Northern Thailand, July and August 1935. Of seven specimens, three have 3 subdorsal and 1 caudal ocelli; two have 2 subdorsal and no caudal ocelli; one has 5 subdorsal and 1 caudal ocelli; and one has 1 subdorsal and no caudal ocellus. The dorsal spines in these specimens number 14 or 15.

The generic name usually given to this species is *Rhynchobdella*, dating from Bloch (1801), with *orientalis* Bloch as the type, that species being a synonym of *Ophidium aculeatum* Bloch (1787). In 1800, however, Lacepède had established the composite genus *Macrognathus*, which Cuvier and Valenciennes (1831, vol. 8) restricted to *aculeatus*, and placed Lacepède's other species, *armatus*, in *Mastocembelus*.

This fish is well known to the Thai, and wherever found it is called *pla lot*, a distinctive name.

Genus MASTOCEMBELUS Scopoli

Mastocembelus Scopoli, Introductio ad historiam naturalem, p. 458, 1777. (Type, *Mastacembelus unicolor* (Kuhl and van Hasselt), Cuvier and Valenciennes.)

The best taxonomic treatment of these fishes is by Boulenger (1912). The characters on which he separated all the species known to him have been used in the following key, into which have been incorporated four recently described forms peculiar to Thailand. Several other Burmese species may be looked for in Siamese waters of the western drainage.

1*a*. Dorsal and anal fins confluent with caudal.

  2*a*. Snout entirely scaly; no preopercular spines; dorsal rays XXVI to XXX, 60 to 70; anal rays III, 59 to 69; body brown, clouded with darker; vertical fins with a yellow margin; a series of black spots at base of dorsal fin____ **maculatus**

2*b*. Snout scaleless or scaly only at sides.
  3*a*. A preorbital spine.
    4*a*. Dorsal spines more than 30, dorsal soft rays 60 to 90.
      5*a*. Dorsal rays XXXIV to XXXIX, 79 to 90; anal rays III, 79 to 90.
        6*a*. Body rich brown above; a blackish zigzag band extending from eye to base of caudal fin, sending branches to dorsal and anal fins------------------------------------ armatus armatus
        6*b*. Body covered with dark brown or black reticulations enclosing large round or oval pale spots; finer reticulations may cover abdomen; vertical fins dark, a dark spot at base of pectoral. armatus favus
      5*b*. Dorsal rays XXXII to XXXIV, 60 to 75; anal rays III, 56 to 75; body brown, with white lines and several rows of small white spots; bases of vertical fins blackish, margins white; a black spot at base of pectoral-- argus
    4*b*. Dorsal spines less than 30, dorsal soft rays 41 to 56.
      7*a*. Dorsal rays XXIX, 46; anal rays III, 56; back and sides brown, under surface yellowish; body with about 18 dark brown cross bands which do not reach midline of back under spinous dorsal fin and extend to edge of anal fin-------------------- circumcinctus
      7*b*. Dorsal rays XXVI to XXVIII, 45 to 48; anal rays III, 41 to 43; back and sides brown, under surface white; body with 16 to 20 irregular blackish cross bands which extend entirely across body and do not reach edge of anal fin------------------ taeniagaster
  3*b*. No preorbital spine; dorsal rays XXXII to XXXVII, 70 to 80; anal rays III, 70 to 80; body black or brown, with 4 longitudinal red bands; vertical and pectoral fins black, with red margin--------- erythrotaenia
1*b*. Dorsal and anal fins not confluent with caudal; no preorbital spine; dorsal rays XVI, 46 to 48; anal rays III, 42 to 45; body with 18 or 19 dark cross bands inclined downward and forward, a narrow dark stripe in interspaces--- paucispinis

MASTOCEMBELUS MACULATUS Cuvier and Valenciennes

Mastacembelus maculatus Cuvier and Valenciennes, 1831, vol. 8, p. 461 (Molucca).
Macrognathus maculatus Bleeker, 1865 (356), p. 174 (Siam).

Only Bleeker has recorded this species from Thailand. It is otherwise known from Java, Borneo, Billiton, and Sumatra. The chief features are the completely scaly snout (not found in any other local form), the presence of a preorbital spine but no preopercular spines, the extension of the mouth to a point under the posterior nostril, and a clouded brown body, yellow margins to the vertical fins, and a series of black spots along the base of the dorsal fin.

MASTOCEMBELUS ARMATUS ARMATUS Günther

Mastacembelus armatus var. *armata* Günther, 1861, vol. 3, p. 543 (Siam; Calcutta; East Indies).
Macrognathus armatus Bleeker, 1865 (356), p. 174 (Siam).
Mastacembelus armatus von Martens, 1876, p. 396 (Bangkok).—Sauvage, 1881, p. 160 (Siam).—Fowler, 1934a, p. 146 (Chiengmai).

The range of this fish extends from India and Ceylon to southern China, and thence through Thailand and Malaya to Sumatra. The

British Museum contains specimens from Thailand in the Mouhot and Schomburgk collections; also specimens from the upper Bangpakong River from the Siamese Museum and from the Menam Chao Phya at Bangkok from Capt. Stanley Flower. In Thailand it is the commonest, most widely distributed, and largest member of the genus. It is found in rivers, canals, swamps, and lakes.

A length of at least 70 cm. is attained in some Thai waters. A specimen, 25.5 cm. long, taken from the Menam Chao Phya at Koh Yai, between Bangkok and Ayuthia, had no preorbital spine but was otherwise typical.

This species, and doubtless others of the genus, subsist on insects, crustaceans, and small fishes.

On account of its shape, slippery skin, powerful muscles, and activity it is difficult to handle, and its short, sharp, stout spines can inflict painful wounds. It is exposed for sale regularly in the markets and it has some use as food.

Everywhere in Thailand it bears the vernacular name of *pla kathing*.

MASTOCEMBELUS ARMATUS FAVUS Hora

Mastacembelus armatus var. *favus* Hora, 1923b, p. 180 (Nontaburi); 1924a, p. 474, fig. 2 (Tale Sap).—Fowler, 1934a, p. 146 (Chiengmai, Bua Yai).

Mastacembelus favus Fowler, 1937, p. 222, figs. 204–209 (Mepoon, Bangkok).

This fish is peculiar to Thailand, as far as present information goes, and it is found at such widely separated places as the Tale Sap in Peninsular Thailand and the upper waters of the Mechem, tributary of the Meping, in Northern Thailand.

A length of 40 cm. is attained by specimens in hand, but a length of 60 cm. is reported by fishermen.

No structural characters have been pointed out by which *M. a. favus* may be distinguished from *armatus* proper, but as a color variety it is well defined. Five specimens, 3.8 to 5 cm. long, collected by Deignan on April 22, 1935, in the Meping at Chiengmai have the body coloration much subdued and the outstanding markings are a row of dark brown spots at the base of the dorsal and anal fins, which are otherwise white. Fowler (1937) has given six excellent figures showing color variation.

MASTOCEMBELUS ARGUS Günther

Mastacembelus argus Günther, 1861, vol. 3, p. 542 (fresh waters of Siam); 1864, p. 179 (Siam and Cambodia).—Peters, 1868, p. 263 (Siam).—von Martens, 1876, p. 396, pl. 10, fig. 4 (Bangkok and Petchaburi).—Günther, 1880, p. 499, fig. 228 (illustration of a specimen "from Siam").—Sauvage, 1881, p. 160 (Siam); 1883b, p. 151 (Menam Chao Phya).—Boulenger, 1912, p. 201 (Siam).—Hora, 1924a, p. 475 (Tale Sap).—Fowler, 1935a, p. 134, figs. 93–96 (Bangkok); 1939, p. 47 (Krabi).

Macrognathus argus BLEEKER, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).

This species appears to be peculiar to Thailand and it is rare. It was described from a specimen 9 inches long collected by Mouhot, listed in the British Museum catalog as from "fresh waters of Siam." Another specimen from Thailand in the same museum was collected by Newman. Von Martens described and figured life size in color a specimen from Bangkok. Bleeker (1865) [347, 356] recorded the species as represented in a collection from Thailand sent to Paris by Bocourt, and Sauvage (1883b) listed it among fishes from the Menam Chao Phya collected by Harmand. The only recent mention of the taking of specimens is by Hora (1924a) and Fowler (1935a, 1939). The former cited one fish taken at the mouth of the Patalung River in the inner lake of the Tale Sap by Dr. Annandale, who stated that when fresh the specimen was dark olive-green with blood-red markings. Fowler gave a good description and figured four color variations in specimens from Bangkok and cited a specimen 38 cm. long from Krabi in Peninsular Siam. Preserved specimens are described as having a brown body marked by white bands on head, several rows of round white spots on body, a white margin to vertical fins, and a dark blotch at base of pectoral fin.

MASTOCEMBELUS CIRCUMCINCTUS Hora

FIGURE 2

Mastacembelus circumcinctus HORA, 1924a, p. 475, fig. 3 (Patalung River, Tale Sap).

This strongly marked species seems to be peculiar to Peninsular Thailand. The type and only specimen seen by Hora came from the inner lake of the Tale Sap and was about 16 cm. long. The present writer collected a specimen, 17 cm. long, in the same water on October 9, 1923, another, 16 cm. long, in the Tale Noi, October 8, 1923, and two specimens, 8 and 9.2 cm. long, in Klong Nakon Noi in the town of Nakon Sritamarat, July 17, 1928.

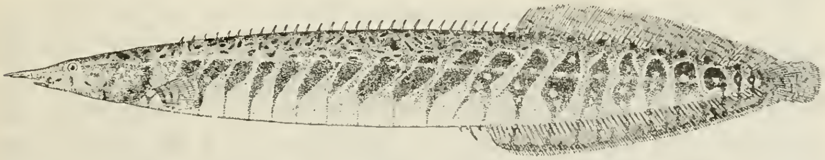


FIGURE 2.—*Mastocembelus circumcinctus* Hora. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Fishes of very similar appearance observed in the Chantabun district of Southeastern Thailand apparently are referable to *M. taeniagaster.*

MASTOCEMBELUS TAENIAGASTER Fowler

Mastacembelus circumcinctus (*non* Hora) Fowler, 1934a, p. 146 (Chantabun).
Mastacembelus taeniagaster Fowler, 1935a, p. 136, figs. 97–101 (Chantabun).

A strongly marked species, known from four specimens, 8.9 to 15.3 cm. long, from Chantabun, in Southeastern Thailand.

The species is close to *M. circumcinctus* but appears to differ in having fewer rays in the anal fin and in details of coloration; thus, the dark bands on the trunk extend to the spinous dorsal fin (but do not reach that fin in *circumcinctus*) and the extension of the dark bands across the tail does not reach the edge of the anal fin (while in *circumcinctus* the dark marks go quite to the free margin of that fin).

MASTOCEMBELUS ERYTHROTAENIA Bleeker

Mastacembelus erythrotaenia Bleeker, 1850 (24), p. 6 (Bandjermassing, Borneo).—Sauvage, 1881, p. 160 (Siam).
Macrognathus erythrotaenia Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).

Bleeker's records are based on a specimen or specimens that he examined in the collection, in the Musée Jardin des Plantes à Paris, made in the Menam Chao Phya by Bocourt. The species was originally described from rivers of Borneo and has since been recorded from Sumatra and Penang.

The relations of the species are indicated in the preceding key. In addition to lacking the preorbital or infraorbital spine that characterizes other local species placed in this group, the markings are striking; the brown or blackish body has four longitudinal red bands, and the dorsal, caudal, anal, and pectoral fins are black with a red margin.

MASTOCEMBELUS PAUCISPINIS Fowler

Mastacembelus paucispinis Fowler, 1939, p. 75, fig. 23 (waterfall at Trang).

This species is known from two specimens, 8.6 and 7.7 cm. long, taken on October 13, 1936, from a waterfall stream near Trang, Peninsular Siam.

In the paratype the anal and caudal fins are continuous, a feature regarded by Fowler as "apparently abnormal"; in the type both the dorsal and anal fins are disconnected with the caudal, as in several Indian species. Associated with this character is the presence of only 16 spines in the dorsal fin, a number much less than in any other known species. From head to base of caudal fin there are 18 or 19 dark bands extending obliquely downward and forward, those over the anal fin continued on the fin, those on the trunk falling short of the median ventral line. In each space between the bands there is a narrow dark stripe parallel with the bands.

Order APODES: Eels

Of the numerous kinds of eels frequenting the waters of Thailand, only a few species are found in fresh water; these belong in three families, as follows:

1*a*. Dorsal and anal fins confluent with the caudal, which completely covers the end of the tail; posterior nostril a circular or oval opening in front of eye.
  2*a*. Body covered with minute embedded scales; teeth small, conic, in bands on jaws and vomer; tongue not fully adnate to floor of mouth, but free at tip and sides; origin of dorsal fin far behind gill openings_ Anguillidae
  2*b*. Body scaleless; teeth in anterior part of jaws caniniform, middle row of vomerine teeth enlarged and strongly canine or compressed; tongue adnate to floor of mouth; origin of dorsal fin above or in advance of gill openings____ Muraenesocidae
1*b*. Dorsal and anal fins not extending to end of the tail, which is pointed and bears no fin, the caudal being absent; body scaleless; tongue adnate to floor of mouth; posterior nostril a slit on inner side of upper lip below or in advance of front border of eye_____________________________ Ophichthyidae

Family ANGUILLIDAE: True Eels

Genus ANGUILLA Shaw

Anguilla SHAW, General zoology, vol. 4, p. 15, 1803. (Type, *Anguilla vulgaris* Shaw.)

The catadromous eels, which are so conspicuous and economically important in the North Atlantic and streams discharging therein, are of comparatively little importance in the Pacific and Indian Oceans, and in Thailand they are so rare as to constitute a curiosity when caught. Several species of wide Oriental distribution (*Anguilla elphinstonei* Sykes, *A. mauritiana* Bennett, *A. celebesensis* Kaup) may be looked for in Thailand, but as yet only one species has been actually found in local waters.

ANGUILLA AUSTRALIS Richardson

Anguilla australis RICHARDSON, 1841, p. 22 (Port Arthur).
Muraena australis FOWLER, 1939, p. 43 (Krabi).

This species, of the Pacific and Indian Oceans, is the only eel of the genus *Anguilla* that has been detected in Thai waters. It was first met with in September 1926 when one 64 cm. long was taken in the Bangkapi Canal in Bangkok. The fish was exhibited alive as an "electric eel" by a man who specialized in freaks and monstrosities shown at fairs. It was inspected by the writer in March 1927 but not critically examined until June 1928, after it had died. A second specimen, 66.5 cm. long, taken in fresh water on Puket Island, off Peninsular Thailand in the Bay of Bengal, was displayed in preservative by Boy Scouts of the Puket district in an exhibition held in Bangkok in

February–March 1927, and subsequently presented to the Siamese Bureau of Fisheries.

Both of these examples were unmistakably referable to this species, having, among other characters, the origin of the dorsal fin immediately opposite the anal opening and the angle of the mouth extending well behind the eye.

A third and only other known specimen from Thailand is recorded by Fowler (1939); it was 63 cm. long and collected September 21, 1936, at Krabi, in Peninsular Thailand.

Family MURAENESOCIDAE: Eels

Genus MURAENESOX McClelland

Muraenesox McClelland, Calcutta Journ. Nat. Hist., vol. 4, p. 408, 1843. (Type, *Muraenesox tricuspidata* McClelland.)

MURAENESOX CINEREUS (Forskål)

Muraena cinerea Forskål, 1775, pp. 10, 22 (Arabia).

While this widely dispersed eel of the Pacific and Indian Oceans is common in the coastal waters of Thailand, it may also be found at times, but apparently very rarely, in the lower courses of the large rivers in water that is perfectly fresh, as in the Menam Chao Phya as far up as Nontaburi, some miles above Bangkok. Von Martens (1876) reported the fish from Bangkok, but his was a market specimen. Fowler (1939, p. 43), under the name *Muroenesox arabicus*, lists a specimen 80.5 cm. long from Krabi in Peninsular Siam but does not indicate whether from salt or fresh water.

A name borne by this fish around the head of the Gulf of Siam is *pla mangkorn* (dragon fish).

Family OPHICHTHYIDAE: Snake Eels

Genus PISOODONOPHIS Kaup

Pisoodonophis Kaup, Catalogue of the apodal fish in the collection of the British Museum, p. 15, 1856. (Type, *Pisoodonophis cancrivorus* Richardson.)

PISOODONOPHIS BORO (Hamilton)

Ophisurus boro Hamilton, 1822, pp. 20, 363 (estuaries of the Ganges near Calcutta).

Pisoodonophis boro Hora, 1923b, p. 173 (Nontaburi).—Smith, 1930, p. 57 (Siam).

Pisodonophis boro Fowler, 1935a, p. 96 (Bangkok).

While this is a marine species, it has the regular habit throughout its wide range (East Indies, China, Indo-China, Thailand, and India) of entering brackish and fresh water and ascending streams. In Thailand it is the common eel of the Menam Chao Phya Basin and of the swamps tributary thereto. At times it is very abundant as far inland as Paknampo, at the head of the Menam Chao Phya, in January and other months of the dry season, and large quantities may be taken to market from the nearby swamps.

The fish reaches a length of nearly 1 meter. The largest actually measured in this country was 83 cm. long, from the Krat River, in Southeastern Thailand.

The evidence is not conclusive, but the statements of fishermen and Government officials indicate that it breeds in swamps and ricefields from June to August.

In the special fishery for this species, traps baited with fish are set in swamps, canals, and along river banks, and 2-pronged spears are used in holes in river banks. The fish has considerable economic importance, as it is popular as food and may easily be kept alive in tubs of water or even out of water for a long time. The usual practice is to cut the body into transverse pieces and cook it with curry.

The vernacular name, *pla lai*, is shared with other eels.

Order SYNBRANCHIA

Two families of this order of eellike fishes are represented in the fresh waters of Thailand.

1*a*. Teeth in bands on jaws and palatines; gill membranes confluent and attached to isthmus by a median septum dividing the gill openings; gills vestigial, on 3 arches------Flutidae

1*b*. Teeth in a single series on jaws and palatines, expanding into a pluriserial patch or band at symphysis of each jaw; gill membranes confluent and not attached to isthmus, the gill openings not being divided by a septum; gills functional, on 4 arches------Synbranchidae

Family FLUTIDAE: Swamp-Eels

Genus FLUTA Bloch

Fluta Bloch, *in* Schneider, Systema ichthyologiae . . ., p. 565, 1801. (Type, *Monopterus javanensis* Lacepède.)

FLUTA ALBA (Zuiew)

Muraena alba Zuiew, 1793, p. 299.

Monopterus javanensis Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).—Günther, 1870, vol. 8, p. 14 (Siam).—Volz, 1906, p. 165 (Menam Chao Phya).

Monopterus javanicus von Martens, 1876, p. 405 (Bangkok).—Sauvage, 1881, p. 164 (Siam).

Monopterus albus Weber and de Beaufort, 1916, vol. 3, p. 413, fig. 211 (Siam).—Fowler, 1934a, p. 86 (Chiengmai, Bangkok).

Fluta alba Smith, 1934b, p. 300 (Siam generally).

In ponds, canals, ditches, ricefields, and swamps all over Thailand this snub-nosed eel may be found in considerable numbers. Specimens have been examined from Peninsular Thailand (mouth of the Patalung River in the inner lake of the Tale Sap), Menam Chao Phya at Bangkok and vicinity, Bung Borapet, and old bed of the Mekong at Chiengrai, Northern Thailand.

It reaches a length of nearly a meter, but examples as large as 70 cm. are uncommon and the usual run is from 25 to 40 cm.

The fish has been described as "degraded rather than primitive"; and although well known and of wide distribution on the Asiatic continent (China to Burma) and in the Japanese, Chinese, and Dutch islands, it has not received from zoologists the attention that its interesting anatomy and habits would seem to warrant.

A paper on the circulation and respiration in this fish, with a general account on its biology and anatomy, was published by Volz (1906), with some notes on the fish in Thailand, as follows:

> What I know about the life habits of this fish does not rest on my own observations. I refer therefore to the place in my diary pertaining to *Fluta*, and written down there is what I could learn from Siamese and Siamese Malays: These fishes are readily eaten by Chinese and Siamese. They inhabit the canals connected with the Menam and the brooks and swamps, and penetrate from here into the inundated ricefields. At the beginning of the dry season they withdraw with the retreating water to the deepest places in the fields, where the moisture remains the longest, and dig themselves into the earth. How they do this, how long they work, and so on, I could not learn. The Europeans knew nothing about it, and I could not speak long enough with the natives. The fishes are caught in the following manner: In the rainy season they take the hook, but in the dry season the natives search for them in the fields. Where a number of these fishes are expected to be in the ground, probings are made with the help of a long 2-pronged iron fork by sticking it into the ground from time to time. If one finds a place where there are fishes, he digs a hole, often 1–1.5 m. deep, and hauls up with the aid of a net. These animals are supposed to be able to live in these holes for months and first begin to come out again with the beginning of the rainy season. The fishes are also supposed to migrate. While they lie in the baskets they produce a noise that appears to come out of the mouth and is not very loud. [Translation.]

The best observations on the eggs and young of *Fluta* have been made in Thailand by Luang Anantamasya Pithaks, of the Siamese Bureau of Fisheries. The fish abounds in Bung Borapet, the large lake, originally a swamp, which has been set aside as a fish preserve and nursery and has been the scene of many studies and experiments on the local fishes. It has long been known to the fishermen of the Bung Borapet region that this eel spawns in the lake, the spawning period extending from July onward. The eggs are laid in shallow water near a bank and are contained in a bubble nest such as is made by various anabantid fishes, but whether both parents take part in blowing the bubbles has not been determined, although the fishermen believe that only the female performs this function. The rafts of eggs are not held in place by aquatic vegetation but float freely in the open water, and the color of the bubble mass undergoes change from time to time during the progress of incubation. On July 12, 1931, the observer named discovered a school of young swamp eels at the surface in shallow water, and nearby, projecting from a hole in the soft bottom, he saw the head of an adult eel, supposed to be the female parent. The young, numbering several hundred, were in a compact mass 20 to 25 cm. wide, and when some of them were scooped up in a coconut shell the adult made no attempt to defend them but withdrew into the hole. The young were of a pale brownish color, with the upper part of the body and head thickly beset with minute dark brown spots. A dark line extended from the eye to the snout, and a dark stripe extended downward and backward from the eye. The average length of 29 specimens was 33.6 mm.; the range being from 27 to 36.5 mm.

This eel is caught in considerable quantities for domestic consumption and local sale, and at times shipments are made to the Bangkok markets. It bears transportation well, as it is able to live out of water for a long time if its skin is kept moist.

The fish seems to have no distinctive vernacular names but shares with other eels the name *pla lai.*

Family SYNBRANCHIDAE

Two Thai representatives of this family of eellike fishes fall into two genera, as follows:

1*a*. Gill openings narrow, forming a single aperture confined to the ventral surface; posterior nostrils oval, above eye; eyes small; origin of dorsal fin in advance of anal opening------------------------------------Synbranchus

1*b*. Gill openings forming a single, very wide aperture extending up sides to lateral line; posterior nostrils oblique, lanceolate, above eyes; eyes minute; origin of dorsal fin opposite anal opening--------------------------Macrotrema

Genus SYNBRANCHUS Bloch

Synbranchus Bloch, Naturgeschichte der ausländischen Fische, vol. 9, p. 86, 1795. (Type, *Synbranchus marmoratus* Bloch.)

SYNBRANCHUS BENGALENSIS (McClelland)

Ophisternon bengalensis McClelland, 1845, p. 197, pl. 11, fig. 1 (Bengal).

Symbranchus bengalensis Károli, 1882, p. 184 (Siam).—Boulenger, 1903, p. 303 (Patani River).

Synbranchus bengalensis Weber and de Beaufort, 1916, vol. 3, p. 416, fig. 213 (Siam).—Hora, 1923b, p. 174 (Bangkok).

The range of this fish extends from India through the Indo-Australian Archipelago to the Philippines, French Indo-China, and Thailand. It is apparently rather rare in Thailand, and the only specimens observed in recent years have been three recorded by Hora (1923b) from Bangkok and one collected in the Menam Chao Phya at Nontaburi on September 26, 1924. The occurrence of the fish in Peninsular Thailand was made known by Boulenger (1903) from a collection in the Patani River by Annandale and Robinson.

A length of 53 cm. is reported for the East Indies. The largest Thai example, from Nontaburi, was 25 cm. long.

Genus MACROTREMA Regan

Macrotrema Regan, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 390, 1912. (Type, *Symbranchus caligans* Cantor.)

MACROTREMA CALIGANS (Cantor)

Symbranchus caligans Cantor, 1849, p. 1316 (Sea of Pinang).
Macrotrema caligans Hora, 1924a, p. 466 (Tale Sap).—Smith, 1934b, p. 324 (Bangpakong River).—Fowler, 1935a, p. 96 (Bangkok).

Although this rare fish of the Malay Peninsula and Java is usually rated as a marine species, the records of its occurrence in Thailand indicate that it may also frequent water that is strictly fresh. It was first given a Thai habitat by Hora (1924a) on the basis of one specimen from the mouth of the Tale Sap at Singora, in salt or brackish water, and one from the fresh inner lake of the Tale Sap at Pakpayum. The only other Thai records are for the Bangpakong River, June 25, 1933, where a specimen was found in a pongpang net in water perfectly fresh and very muddy, and for Bangkok one specimen, probably a market fish, listed by Fowler (1935a).

A maximum length of 20 cm. is reported for this species. The specimen from the Bangpakong River was 17 cm. long; its general color was pinkish purple, with the fins carmine; its caudal fin had 15 rays, although Cantor's figure as copied by Bleeker (301, vol. 4, p. 119) shows 9 rays.

Order EVENTOGNATHI: Carps, minnows, loaches, etc.

The fishes of this vast cosmopolitan order found in the fresh waters of Thailand fall into four families, which may be recognized by characters indicated in the key below. The body is covered with cycloid scales, rarely wholly or partly scaleless; the lateral line is almost always present and complete. The mouth is toothless and the food is restricted in consequence; forms with long, convolute intestines are vegetarian, those with short intestines subsist chiefly on minute animals. Barbels are present or absent. The lower pharyngeal bones are falciform and in all but one of the local families are armed with well-developed teeth, which may be in one to three series. The single dorsal fin is composed largely of soft branched rays, but the anterior rays are unbranched and the last simple ray may be ossified into a spine, which may bear weak or strong denticulations. All the species are oviparous.

1*a*. A single external gill opening on each side; pharyngeal teeth present.
  2*a*. Head and body mostly compressed, not flattened below; ventral and pectoral fins not inserted horizontally; only outermost ray of pectoral fins simple.
    3*a*. No suborbital or preorbital spine; mouth terminal or inferior; barbels none, or 2, or 4; pharyngeal teeth in 1, 2, or 3 rows; air bladder divided into 2 anteroposterior parts, not enclosed in bone__________Cyprinidae
    3*b*. A suborbital or preorbital spine present or absent; mouth inferior; barbels 6 or 8; pharyngeal teeth in a single row; air bladder enclosed in bone, its posterior part small or vestigial__________________Cobitidae
  2*b*. Head and body depressed, flattened below; ventral and pectoral fins inserted horizontally; several outer or inner pectoral rays simple; no suborbital or preorbital spine; mouth inferior; pharyngeal teeth in a single row; at least three pairs of barbels; air bladder reduced, consisting of two connected lateral parts enclosed in bone____________Homalopteridae
1*b*. Two external gill openings on each side; mouth inferior; pharyngeal teeth absent; upper and lower lips coiled together in postlabial groove; barbels absent; ventral and pectoral fins horizontal_______________Gyrinocheilidae

Family CYPRINIDAE: Minnows and carps

It is in this family that the fresh-water fishes of Thailand reach their greatest development as regards number of genera and species and number of individuals. The number of species exceeds those known from French Indo-China, from Malaya, from the Indo-Australian Archipelago, or from Burma. Even in India, with seven times the area of Thailand, this family is scarcely more numerously represented.

For convenience the following subfamilies may be recognized:

1*a*. Upper lip separated from skin of rostrum by a deep groove; base of upper lip more or less covered by a pendulous rostral fold; mouth anterior, subinferior, or conspicuously inferior.
  2*a*. Abdomen compressed into a sharp edge; no barbels; pharyngeal teeth in 2 or 3 rows; dorsal fin with 7 to 10 branched rays; arising in posterior half of body and inserted opposite anal or opposite space between anal and ventrals; anal fin with 12 to 48 branched rays____________Abraminae
  2*b*. Abdomen rounded or flat, not compressed into a sharp edge; barbels present or absent; pharyngeal teeth in 1, 2, or 3 rows.
    3*a*. Generally a knob at symphysis of lower jaw fitting into an emargination in upper jaw; barbels rostral and maxillary, but one or both pairs may be absent; dorsal fin with 6 to 16 branched rays and without any osseous simple rays, arising behind origin of ventrals; anal fin with 5 to 17 branched rays; lateral line if present with an abrupt downward curvature anteriorly, if complete running in lower half of caudal peduncle____ Rasborinae
    3*b*. No knob at symphysis of lower jaw; barbels rostral and maxillary, but one or both pairs may be absent; dorsal fin with 7 to 30 branched rays and with or without an osseous simple ray, which may be smooth or denticulated, arising before, over, or behind origin of ventrals; anal fin with 5 to 9 branched rays and with or without an osseous simple ray; lateral line (with two exceptions) running along middle of caudal peduncle____ Cyprininae

1*b*. Upper lip not separated from snout by a groove but continuous with skin of snout; mouth conspicuously inferior; lower lip with or without a sucking disk-- **Garrinae**

Subfamily ABRAMINAE

These fishes are a rather conspicuous element in the fresh-water fauna in all parts of the country. They may at once be recognized by the greatly compressed body and the cultrate ventral edge, which, in the local genera, extends along the whole length of the abdomen. Seven genera and 17 species are herein considered:

1*a*. Ventral fins present.
  2*a*. Predorsal scales extending between eyes; mandibular symphysis with a well-developed hook fitting into a depression in upper jaw.
    3*a*. Pectoral fins inserted above ventral profile, which is evenly curved throughout; body oblong; scales of medium size, not over 70 in lateral line; of small size---**Oxygaster**
    3*b*. Pectoral fins inserted in the ventral profile, which is convex anteriorly and straight between pectorals and ventrals; body very elongate; scales very small, more than 115 in lateral line; of large size. **Macrochirichthys**
  2*b*. Predorsal scales not extending between eyes; mandibular symphysis with or without a hook or knob fitting into a depression in upper jaw.
    4*a*. Dorsal fin entirely opposite anal; no hook or knob at mandibular symphysis; pharyngeal teeth triserial; scales in lateral line 31 to 37. **Chela**
    4*b*. Dorsal fin entirely or partly in advance of anal; hook or knob at mandibular symphysis more or less developed.
      5*a*. Pharyngeal teeth biserial; ventral fins far forward, their base nearer to head than to anal fin; lateral line continuous; scales in lateral line 74 to 75; gill rakers over 100--------**Longiculter**
      5*b*. Pharyngeal teeth triserial; ventral fins farther back, their base much nearer to anal fin than to head; gill rakers less than 50.
        6*a*. Body moderately elongate, with dorsal and ventral profiles strongly curved; usually a slight nuchal concavity; postorbital region short, less than 0.5 length of head; air bladder bipartite; scales in lateral line 50 to 70--------------------------------**Paralaubuca**
        6*b*. Body more elongate, with profile from tip of snout to dorsal fin straight and horizontal or very slightly curved; no nuchal concavity; ventral profile strongly curved; postorbital region long, more than 0.5 length of head, air bladder tripartite; scales in lateral line over 90--------------------------------------**Cultrops**
1*b*. Ventral fins absent; dorsal fin over anal; branched anal rays 30 to 35---**Parachela**

Genus OXYGASTER van Hasselt

Oxygaster VAN HASSELT, Alg. Konst. Letterbode, vol. 2, p. 132, 1823. (Type, *Oxygaster anomalura* van Hasselt.)

Fishes now assignable to this genus were for many years listed under the name of *Chela*, a composite genus of Hamilton (1822). Bleeker

1863 [314] made *Chela cachius* of Hamilton the genotype, but his action seems to have been generally disregarded (Day, Günther, Weber and de Beaufort). The next available name is *Oxygaster* of van Hasselt, 1823.

These fishes are easily distinguishable by the extension of the nuchal scales into the interorbital space, in addition to the other features shown in the preceding key.

Fowler (1934a) described, as new species of *Chela* from Thailand, *C. pointoni*, *barroni*, and *stigmabrachium*, but only the first of these conformed with the definition *of Chela* (i. e., *Oxygaster*). Later Fowler (1935a, 1937) placed them, including *pointoni*, in *Culter*.

Bleeker (1865 [356]) listed without description *Chela castelnaui* from Bangkok. The name is based on a drawing in Count Castelnau's album of Siamese fishes and appears to have no standing.

Following is a key to the species of *Oxygaster* recorded from Thailand:

1*a*. Caudal fin with a sharply defined black spot on each lobe; scales in lateral line 42, in transverse series to base of ventral fin 10.5–1–5____maculicauda
1*b*. Caudal fin with no black spot on either lobe.
  2*a*. Scales in lateral line 50 to 60, in transverse series to base of ventral fin 11 or 12–1–5 to 7; origin of dorsal fin opposite or slightly in advance of origin of anal fin____anomalura
  2*b*. Scales in lateral line 30 to 43.
    3*a*. Depth 2.75 to 3.6 in length and greater than head; pectoral fins extending beyond base of ventral.
      4*a*. Scales in transverse series 8–1–3; origin of dorsal fin slightly in advance of origin of anal____siamensis
      4*b*. Scales in transverse series 6 or 7–1–4; origin of dorsal fin opposite or behind origin of anal____oxygastroides
    3*b*. Depth about 4.25 in length and equal to head; scales in transverse series 8–1–3; origin of dorsal fin far in advance of origin of anal fin; pectoral fin extending to base of ventral____pointoni

OXYGASTER MACULICAUDA (H. M. Smith)

Chela maculicauda SMITH, 1934b, p. 301 (Tale Sap).

This strikingly marked little fish is known only from three specimens, 5.5 cm. long, taken by the writer in Klong Ranoad, a tributary of the inner lake of the Tale Sap, Peninsular Siam, October 9, 1923. No other species of *Oxygaster* has a black spot on each caudal lobe.

The type is U. S. N. M. No. 103372.

OXYGASTER ANOMALURA van Hasselt

Oxygaster anomalura VAN HASSELT, 1823, p. 133.
Chela oxygaster WEBER and DE BEAUFORT, 1916, vol. 3, p. 52 (Sumatra; Java; Borneo; Malacca).

The range of this species includes Java, Borneo, Sumatra, and Malaya, as well as Thailand. Its inclusion in the local fauna rests on a few specimens from widely separated localities. Four specimens collected in the Tale Noi, September 28, 1927, agree well with the descriptions of Bleeker and of Weber and de Beaufort, except that the origin of the dorsal fin is a little farther in advance of the anal than shown in Bleeker's plate. A specimen, 15.5 cm. long, taken in the Chantabun River, May 25, 1925, has the origin of the dorsal fin very slightly in advance of that of the anal.

A length of 20 cm. is attained by the species in the East Indies.

O. anomalura is the genotype of *Oxygaster*. The species is the only one mentioned in the description of the genus and is clearly entitled to recognition over *Leuciscus oxygaster*, described by Cuvier and Valenciennes more than 20 years later.

OXYGASTER SIAMENSIS (Günther)

Chela siamensis Günther, 1868, vol. 7, p. 336 (Pachebon).
Paralaubuca siamensis Sauvage, 1881, p. 164 (Pachebon); 1883b, p. 153 (Menam Chao Phya).
Oxygaster siamensis Fowler, 1935a, p. 110, fig. 44 (Bangkok).

The type of this species, 4 inches long, collected by the celebrated traveler and explorer Mouhot, is in the British Museum; it was obtained at Pachebon, or Pechabun, a town on the upper Pasak River, on the eastern confines of Central Thailand. The British Museum has three other specimens from the Siamese Museum collected in the upper Bangpakong River, in the southeastern part of Central Thailand. Sauvage listed the species from the "Menam." One other specimen, 83 mm. long, taken at Bangkok, was cited by Fowler, whose description is in none too exact agreement with Günther's.

OXYGASTER OXYGASTROIDES (Bleeker)

Leuciscus oxygastroides Bleeker, 1852 (55), p. 431 (Prabukarta, Borneo; Palembang, Sumatra; Batavia).
Chela oxygastroides von Martens, 1876, p. 403 (Bangkok).—Weber and de Beaufort, 1916, vol. 3, p. 51 (Siam).—Hora, 1923b, p. 152 (Bangkok); 1924a, p. 469 (Tale Sap).
Oxygaster oxygastroides Fowler, 1935a, p. 110 (Bangkok); 1937, p. 167 (Mepoon, Bangkok); 1939, p. 44 (Krabi).

In the Indo-Australian Archipelago this is a common fish in Java, Borneo, and Sumatra. It is the outstanding species of *Oxygaster* in Thailand, widely distributed and in places abundant. In Central Thailand, the fish has been collected in the Menam Chao Phya throughout its length from Bangkok to Paknampo; in the Menam Nan near Paknampo; in the Menam Sak at Dha Luang; in the Menam Bangpakong; and in the Meklong at Rajaburi. In the Peninsular region it has been taken in Klong Sao Tong, Nakon Sritamarat; in the Tale Sap; in the Tale Noi; and at Krabi. In the Tale Noi the fish is very common and conspicuous in the commercial catch. The only record for the eastern region is a typical specimen taken February 16, 1927, in the Nam Pong, a tributary of the Mekong, at Pong.

While the fish reaches a length of 20 cm. in the Dutch islands, the largest specimens measured in Thailand have been 14.3 cm. long. Examples 9 to 12 cm. long are common.

The pigmentation of the fins varies considerably with age and locality. The pectoral fins in some specimens (as from Tale Noi) are black almost throughout, and the dorsal, caudal, and anal fins may be blackish. In some examples the black in the caudal is concentrated into a longitudinal band on each lobe. On the other hand, some specimens show no black whatever on any fins.

Living colors in specimens taken in the Bangpakong River on June 27, 1933, were: Back light green; sides and below silvery white; a lustrous golden band along the side (becoming silvery in alcohol); caudal fin yellow-green above and below, with its central part white and its posterior margin black; pectorals blackish.

The fish is well known to the Siamese under the name *pla paep* (flat fish). In the lower Nan River the name *pla paep khao* (*khao*, white) has been noted. The name *pla tong plu* recorded by Hora (1923b) as used in Bangkok is properly applied to *Cultrops siamensis.*

OXYGASTER POINTONI (Fowler)

Chela pointoni Fowler, 1934a, p. 108, fig. 60 (Chiengmai).
Culter pointoni Fowler, 1935a, p. 109 (Siam, incidental mention).

Known from a single specimen, 75 mm. long, taken at Chiengmai, Northern Thailand, presumably from the Ping River, January 5, 1933. It is a rather slender form, with comparatively large scales and with the dorsal fin beginning well in front of the anal.

The fish is a typical *Oxygaster*, with nuchal scales extending above middle of eyes. Through error it was later referred to *Culter* by Fowler.

Genus MACROCHIRICHTHYS Bleeker

Macrochirichthys Bleeker (261), Act. Soc. Sci. Indo-Néerl. (Cyprinorum), vol. 7, p. 439, 1860. (Type, *Macrochirichthys uranoscopus* Bleeker.)

MACROCHIRICHTHYS MACROCHIRUS (Cuvier and Valenciennes)

Leuciscus macrochirus Cuvier and Valenciennes, 1844, vol. 17, p. 348 (Java).
Macrochirichthys uranoscopus Bleeker, 1863 (301), vol. 3, p. 137 (Menam near Bangkok); 1865 (356), p. 176 (Siam).—Sauvage, 1881, p. 164 (Siam); 1883b, p. 153 (Menam Chao Phya).
Chela macrochir von Martens, 1876, p. 403 (Bangkok).
Macrochirichthys macrochirus Weber and de Beaufort, 1916, vol. 3, p. 54 (Siam).—Hora, 1923b, p. 149 (Bangkok, Nontaburi).—Fowler, 1937, p. 167 (Mepoon, Kemarat).

Macrocheirichthys laosensis Fowler, 1934a, p. 112 (Mekong at Chiengsen).
Macrochirichthys laosensis Fowler, 1935b, p. 510 (Old Chiengsen).

The range of this fish covers Java, Sumatra, Borneo, and French Indo-China, as well as Thailand. While primarily an inhabitant of the larger rivers, in Thailand it occurs also in lakes. It reaches its greatest abundance in the large streams of the Central area. It is known also from rivers in the Peninsula (the Tapi), and from the Tale Sap and the Tale Noi.

This is the largest of the local abramid fishes, attaining a length of more than half a meter.

In Bangkok it has some reputation for gameness and is sought by anglers using a light rod.

It is believed that *Macrochirichthys laosensis* Fowler (1934a), from the Mekong at Chiengsen, Northern Thailand, is this species. The type and paratype are comparatively small (220 and 152 cm.), and the differences from typical *Macrochirichthys macrochirus* may be due to size or age. In Fowler's detailed description no comparison is made with *M. macrochirus* except in the matter of dark spots in the predorsal region and on the lateral line at the base of the caudal. The species was described as having one or two dark saddle-like blotches on the back behind the head, but the figure shows three blotches, and a later specimen from the type region had none (Fowler, 1935b). The exact position of the dark spot at the posterior end of the lateral line is believed to be subject to variation.

Owing to its peculiar shape it is readily recognized and it has received the distinctive vernacular name *pla dab lao* (*dab lao*, Lao sword). In the Tapi River, in the Tale Sap, and in other parts of the Peninsular region the fish is known as *pla pak pra* (*pak pra*, knife sheath). A name in use in the Bangkok region is *pla tong plu*, shared with *Cultrops*.

Genus CHELA Hamilton

Chela Hamilton, Fishes . . . River Ganges, 1822, p. 383. (Type, *Cyprinus cachius* Hamilton.)

The fishes herein included in the genus *Chela* have been placed at various times and by various authors in the genera *Perilampus* of McClelland (1839), *Laubuca* of Bleeker (1860), and *Cachius* and *Eustira* of Günther (1868). Bleeker in 1863 (314, p. 215) restricted Hamilton's name *Chela* to the Indian *cachius*, the species first mentioned by Hamilton (1822 p. 384), and thus precluded the subsequent use of that name for fishes that are properly placed in *Oxygaster* of van Hasselt.

For the composite genus *Perilampus* no type was indicated until 1863, when Bleeker (328, p. 258) gave *P. devario* McClelland (=*Cabdio devario* Hamilton) as the genotype; this species is a *Danio* (Hamilton, 1822), and *Perilampus* is thus a synonym thereof. Bleeker in 1863 (314, p. 215) made *Perilampus guttatus* McClelland (=*Chela laubuca* Hamilton) the type of *Laubuca*, which thus became a synonym of *Chela*, *laubuca* and *cachius* being congeneric. Günther made Hamilton's *Chela atpar* (=*C. cachius*) the type of *Cachius*, which is also a synonym of *Chela* as here defined.

These are small fishes of streams and ponds in India, Burma, Ceylon, Thailand, and Sumatra. None reaches a greater length than 10 cm., and most of them are much smaller. The body is deep and greatly compressed, the abdominal edge is cultrate, the mouth is terminal and directed obliquely to vertically upward, the lateral line is deeply decurved and parallel with the ventral outline, the anal fin is many-rayed and longer than the dorsal, the pectoral fins are long and pointed, and the outer ray of the ventral fins is elongated. Three species have been reported from local waters, differentiated as follows:

1*a*. Body very deep, its greatest depth 2.15 to 2.25 times in standard length; anal rays ii, 22 or ii, 23.
  2*a*. Scales in lateral line 35, above lateral line 9, below lateral line to base of ventrals 3 or 4, around narrowest part of caudal peduncle 12; a conspicuous bright blue spot on top of head, another in front of dorsal fin; 4 to 9 short vertical blackish stripes above pectoral fin, a blackish-green spot on shoulder -- caeruleostigmata
  2*b*. Scales in lateral line 31, above lateral line 7, below lateral line to base of ventrals 5, around narrowest part of caudal peduncle 14; no blue spots on head and back; no dark vertical stripes on side; a conspicuous round blackish spot on shoulder -- mouhoti
1*b*. Body more elongate, its greatest depth 2.8 to 3.6 times in standard length; scales in lateral line 32 to 37; in transverse line 6.5–1–2 or 3 to base of ventrals; anal rays ii, 17 to ii, 21; a blackish spot on shoulder, another at base of caudal fin, these connected by a blackish line ------------ laubuca

CHELA CAERULEOSTIGMATA (H. M. Smith)

FIGURE 3

Laubuca caerulcostigmata SMITH, 1931a, p. 5, fig. 3 (Menam Chao Phya, Bung Borapet).

This dainty and strikingly marked little fish has been observed only in the Menam Chao and tributaries in Central Thailand. It first came in for special notice on January 5, 1925, when, by the use of a short-handled dip net under the muddy bank of the river, near Nakon Sawan, the writer caught in a short time 10 specimens somewhat over 6 cm. long. Placed in a bucket of turbid river water, the fish were nearly invisible even when close to the surface except for a bright caerulean-blue area on the top of the head and another on the median line of the back in advance of the dorsal fin. Immediately after being placed in formalin, the specimens exhibited 4 to 9 short vertical blackish stripes

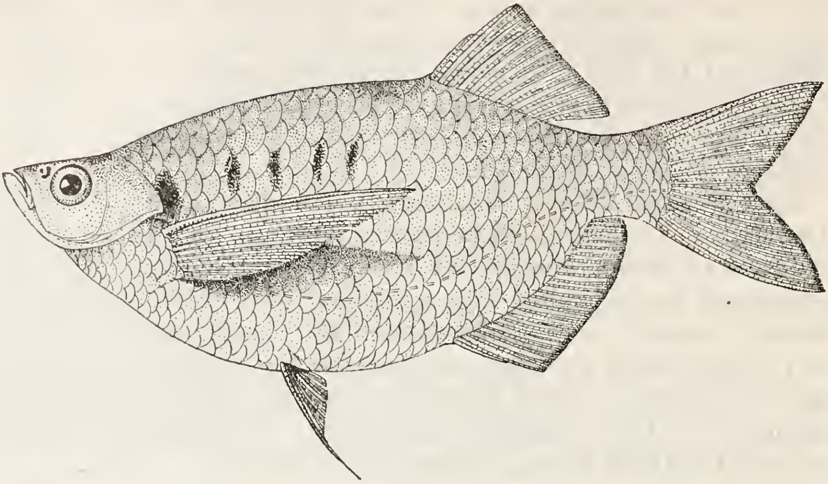


FIGURE 3.—*Chela caeruleostigmata* (H. M. Smith). Drawn by Luang Masya; courtesy of the Thailand Government.

on the side between the head and the dorsal fin, and the blue spots disappeared. Specimens had previously been obtained in an outlet of Bung Borapet near Paknampo in November 1923, and in the main river near Chainad in December 1924.

CHELA MOUHOTI, new species

FIGURE 4

Description.—Depth 2.25 in standard length; least depth of caudal peduncle less than 2 in head and about equal to length of peduncle; dorsal profile nearly straight from tip of snout to point of middle of back, thence a gentle convex curve to origin of dorsal fin; ventral profile markedly and regularly decurved from mouth to base of caudal, its lowest part at ventral fins; head small, sharp, about 4 in standard length; mouth very small, strongly oblique, tip of lower jaw on level with pupil, posterior end of maxillary at lower level of pupil; eye about 3 in head, equal to interorbital space and longer than snout.

Squamation: scales in lateral line 31 (including 3 or 4 non-tube-bearing scales in pectoral axil), in transverse line 7–1–5 or 6, in predorsal region 20, around caudal peduncle 14.

Fins: Dorsal origin over anal origin, two-thirds distance from tip of snout to last scales on caudal base, dorsal rays iii,10, first branched ray shorter than head less snout, edge of fin straight; caudal forked, much longer than head; anal rays iii,23, margin slightly incised, longest branched ray about equal to longest dorsal; ventrals more than half length of head; pectorals equal to depth of body and 1.75 length of head, reaching to anal.

Coloration: Bluish silvery; a glistening round black spot a little larger than pupil immediately behind head; a faint median dark stripe on back from head halfway to dorsal fin; back at base of dorsal and on upper part of caudal peduncle dark; dorsal and pectorals with blackish dots distally, caudal lobes dusky.

Type.—A specimen (U. S. N. M. No. 107959), 5.8 cm. long, was taken in the Pasak River at Pechabun, Central Thailand, February 23, 1934, by Luang Masya Chitrakarn.

Remarks.—This fish is much deeper in color than the Indian and Burman species *C. cachius*, which it resembles in plainness of coloration and which, moreover, has 55 to 66 scales in the lateral line. It is likewise a much deeper colored fish than *C. laubuca* and differs otherwise in the features shown in the key. The closest relationship seems to be with *C. caeruleostigmata*, from which it may be easily distinguished by its squamation (scales in lateral line 31 as against 35, scales on transverse series 7–1–5 as against 9–1–3, scales around caudal peduncle 14 as against 12) and coloration.

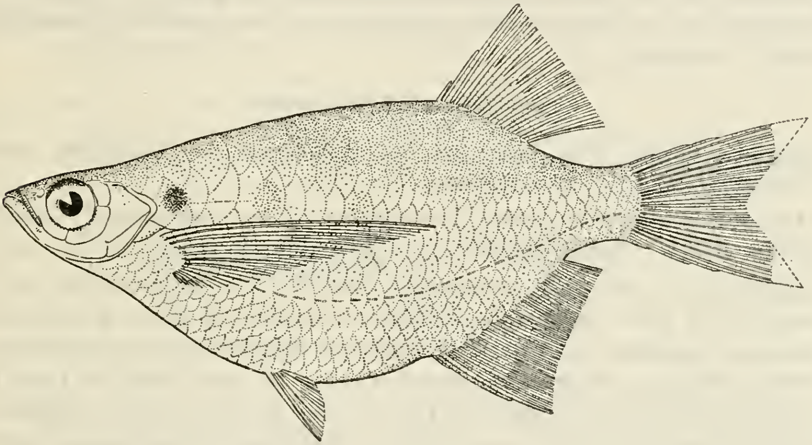


FIGURE 4.—*Chela mouhoti*, new species: Type specimen (U. S. N. M. No. 107959). Drawn by Miss Jane Roller.

Named for A. H. Mouhot, intrepid pioneer explorer and zoological collector in the jungles of Eastern Thailand, 1858–60. He collected fishes in the type locality of *C. mouhoti*, including a new species of *Chela* (i. e., *Oxygaster*) described by Günther as *siamensis*.

CHELA LAUBUCA (Hamilton)

Cyprinus laubuca HAMILTON, 1822, pp. 260, 384 (northern Bengal).
Laubuca siamensis FOWLER, 1939, p. 64, fig. 14 (Trang).

The inclusion of this species of India, Burma, and Sumatra in the present catalog depends in part on the existence of a typical specimen collected by R. Havmöller in September 1926 in a tributary of the Poom Duang River, in Chaiya Province, Peninsular Thailand; this specimen was presented to the Siamese Bureau of Fisheries.

It is believed that *Laubuca siamensis*, based on three specimens 4.2 to 6 cm. long from a waterfall stream near Trang, is the present species. In the comparison of *L. siamensis* with *Chela laubuca* made by Fowler, stress was laid on the slender body of the former (depth 3.2 to 3.5, 3 in figure) as compared with Day's account of *C. laubuca* from India and Burma (depth 2.75 in figure, 3.5 to 4.25 in length with caudal fin). Weber and de Beaufort (1916, vol. 3), however, gave the depth in the standard length of *C. laubuca* as 3.2 to 3.6; and they described the ventral and pectoral fins as noted by Fowler and showed the squamation, fin rays, and coloration in almost perfect agreement with *L. siamensis*.

Genus LONGICULTER Fowler

Longiculter Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 162, 1937. (Type, *Longiculter siahi* Fowler.)

In establishing the genus *Longiculter* to accommodate *L. siahi*, Fowler wrote: "Differs from *Culter* and related genera in its well-elongated and strongly compressed body." The genus must rest, however, on other characters, because in neither of those mentioned is it at all peculiar; a greatly compressed body being typical of the cultrid fishes, and this particular fish being no more elongate than 4 or 5 local cultrid forms described by Fowler as new species. Apparently the genus should be based chiefly on the biserial pharyngeal teeth and the extremely numerous gill rakers (106 on the first gill arch) together with a combination of characters shared with related cultrid genera.

LONGICULTER SIAHI Fowler

Longiculter siahi Fowler, 1937, p. 162, fig. 100 (Mepoon).

This species was described from two specimens, 20 and 19.8 cm. long, taken at Mepoon, Central Thailand.

Genus PARALAUBUCA Bleeker

Paralaubuca Bleeker (301), Atlas ichthyologique, vol. 3, p. 133, 1863. (Type, *Paralaubuca typus* Bleeker.)

This genus was established for the accommodation of a new fish collected in Thailand by Dr. F. Bocourt. The genus dates from 1863, when Bleeker (301) gave a brief diagnosis, with indication of the type species, in a footnote in volume 3 of the Atlas Ichthyologique. A full description of the genus and the species was published by Bleeker (344) in 1865) from which Jordan (1919, pt. 3, p. 335) dated the genus.

Paralaubuca is very close to *Cultrops* of H. M. Smith and may prove to be identical, in which case the name would replace *Cultrops*. The general appearance of typical *Paralaubuca* differs from that of *Cultrops siamensis* (Hora), and there seem to be certain definite characters by which the genera may be separated, as indicated in the foregoing key. It should be pointed out, however, that one of these characters—the bipartite swim bladder in *Paralaubuca*—has not been verified for all the species herein placed in that genus. The Thailand species are distinguished as follows:

1*a*. Scales in lateral line less than 50 (46); scales in transverse series between midline of back and lateral line 8; predorsal scales 36; gill rakers on lower arm of first arch 18; branched anal rays 28------------------- barroni
1*b*. Scales in lateral line 50 to 66; scales in transverse series between midline of back and lateral line 11 to 14; predorsal scales more than 40; gill rakers on lower arm of first arch 27 to 33; branched anal rays 25 to 30.
  2*a*. Scales in lateral line 62 to 66; scales between lateral line and base of ventral fin 3; predorsal scales about 45; origin of dorsal fin nearer to eye than to base of caudal fin; origin of anal fin well behind last dorsal rays; pectoral fin with large blackish or dark area--------- stigmabrachium
  2*b*. Scales in lateral line 50 to 60; origin of dorsal fin nearer to base of caudal fin than to eye; origin of anal fin under last dorsal rays; pectoral fin with no large blackish or dark area.
    3*a*. Scales between lateral line and base of ventral fin 4 or 5; predorsal scales 42 to 59--- riveroi
    3*b*. Scales between lateral line and base of ventral fin 5 to 7; predorsal scales 27 to 30--- typus
1*c*. Scales in lateral line 75; scales in transverse series between midline of back and lateral line 14; predorsal scales 45; gill rakers on lower arm of first arch 30; branched anal rays 20----------------------------- harmandi

PARALAUBUCA BARRONI (Fowler)

Chela barroni Fowler, 1934a, p. 109, fig. 61 (Mekong at Chiengsen).
Culter barroni Fowler, 1937, p. 164 (Pitsanulok, Kemarat).

The type specimen was 10.4 cm. long. Later numerous specimens 5.6 to 15 cm. long were obtained from Pitsanulok, on the Nan in Central Thailand, and from Kemarat, on the Mekong in Eastern Thailand.

Of all the local species of this genus, *P. barroni* has the largest and fewest scales and fewest gill rakers. Fowler gives 46 scales in the lateral line, 8 between the lateral line and the origin of the dorsal, and 38 in the predorsal region; and 18 gill rakers on the lower arm of the first arch.

PARALAUBUCA STIGMABRACHIUM (Fowler)

Chela stigmabrachium Fowler, 1934a, p. 109, fig. 62 (Mekong at Chiengsen).
Culter stigmabrachium Fowler, 1937, p. 166 (Bangkok, Mepoon, Tachin, Kemarat).

Inhabiting the basins of both the Mekong and the Menam Chao Phya, this species is now represented by numerous specimens in collections. A length of 16 cm. is attained.

Fowler considers the species as "chiefly distinguished by the large, dark, suffused blotch on the median part of the pectoral fin, its coloration largely brilliant white with greenish yellow vertical fins." The species is close to *P. typus* in which the pectoral fins are often wholly or partly blackish, and like *P. typus* has the lateral line discontinuous. with overlapping sections.

PARALAUBUCA RIVEROI (Fowler)

Culter riveroi Fowler, 1935a, p. 108, fig. 34 (Bangkok) ; 1937, p. 166 (Pitsanulok, Mepoon).

The type, 15.3 cm. long, was taken at Bangkok in May 1934, and in 1936 specimens were obtained at Pitsanulok and Mepoon, all in the basin of the Menam Chao Phya. The relationship to other local species is brought out in the key.

PARALAUBUCA TYPUS Bleeker

Paralaubuca typus Bleeker, 1863 (301), vol. 3, p. 133 (Siam) ; 1865 (344), p. 16 (Siam) ; 1865 (347), p. 35 (Siam) ; 1865 (356), p. 176 (Siam).—Hora, 1923b, p. 148, pl. 10, fig. 2 (Bangkok, Nontaburi).—Fowler, 1934a, p. 108 (Bangkok).

Chela paralaubuca Günther, 1868, vol. 7, p. 337 (Bangkok). ,

Pseudolaubuca lateralis Sauvage, 1876, p. 98 (Mekong) ; 1881, p. 189 (noted as synonym of *P. typus*).

Culter typus Fowler, 1935a, p. 109 (Bangkok) ; 1937, p. 164, fig. 102 (Bangkok, Pitsanulok).

De Beaufort (1933, p. 33) recorded this fish from Pahang River, Malay Peninsula. It is one of the commonest cyprinoid fishes in Central Thailand. Specimens have been collected throughout the Menam Chao Phya, in Bung Borapet, in the Menam Nan, in the Meklong, and in connecting streams and canals. Fishes taken by the writer at Chiengrai in the Mekok, a tributary of the Mekong, present no apparent differences from specimens from the Menam Chao Phya. In land-locked ponds of limited size the fish does well. A pond 25 meters in diameter in the writer's garden in Bangkok contained many fishes of full size and evidently in good condition.

The British Museum contained eight specimens from the Mekong representing Sauvage's *Pseudolaubuca lateralis*.

The fish reaches full maturity when 13 to 15 cm. long. The largest, taken at the end of the dry season, have reached 17.5 to 18 cm., which appears to be about the maximum size. Spawning occurs at the beginning of the rains.

The species, although quite well marked, is somewhat variable. The scales in the lateral line may number from 50 to 62. The scales in transverse series to the base of the ventral fin are given by Hora (1923b, pl. 10, fig. 2) as 11–1–2.5; Fowler (1935a) describes specimens from Bangkok with the linea transversa 14–1–3, while a figure published by Fowler (1937) shows 11–1–5 or 6. Bleeker's original description gives 20 but does not show separately the parts of the transverse line.

A normal but not invariable character in this species is the presence of a disconnected lateral line, with the anterior part overlapping the first 6 to 20 scales of the posterior part, which is one row below the anterior part. The variations consist in (1) a single lateral line on one side, a double lateral line on the other; (2) a double lateral line on both sides; (3) a single lateral line on both sides. Fish caught at one time in one place may show all these variations; and sometimes all specimens in one haul of a seine or dip net may have double lines on both sides or single lines on both sides. The interruption usually comes at about the 18th to 20th scale, and the overlap covers 6 to 10 scales. In some specimens a large offshoot of the lateral line elements extends obliquely from the anterior part of each scale, upward on the upper part of the lateral line and downward on the lower part. Bleeker made no reference to the interrupted lateral line, and presumably his limited material did not show this feature; but Hora (1923b) found it in his specimens from the Bangkok region.

Günther (1868, vol. 7) took wholly unwarranted liberties with Bleeker's *Paralaubuca typus*. He regarded Bleeker's genus as synonymous with *Chela* and suppressed Bleeker's specific name, giving the fish a new name of his own choosing, so that in his Catalogue this species is recorded only from Bangkok and stands as *Chela paralaubuca* Günther!

The Thai name for this fish throughout its range is *pla paep* (flat fish).

PARALAUBUCA HARMANDI Sauvage

Paralaubuca harmandi Sauvage, 1883b, p. 153 (Menam Chao Phya).

Owing to inadequate description by Sauvage, the exact status and relationships of this species have been somewhat uncertain. From the only other species (*P. typus*) known at the time, this form appeared to be distinguished chiefly by the increased number of scales in the lateral line and the reduced number of branched rays in the anal fin. Sauvage's statement "maxillaire s'etendant jusqu' au niveau des ventrales" is unintelligible. The type was 17 cm. long and was among a collection of fishes from the Menam Chao Phya carried to Paris by Harmand. No other specimens referable to this species have been reported.

Through the courtesy of Dr. Jacques Pellegrin, professor in the National Museum of Natural History in Paris, it has been possible to obtain a description of the type specimen and to make an evaluation of the species. Dr. Pellegrin kindly examined the type (which bears the number A6427) and furnished the following information which, with Sauvage's description, affords a clear idea of the specific characters: The number of scales reported in the lateral line, namely 75, is confirmed; the scales in transverse series are 14 above the lateral line, 7 below the lateral line to the middle of the abdomen, and 4 between the lateral line and the base of the ventral; the predorsal scales number 45; the gill rakers on the lower arm of the first arch are 30; the natatory vesicle is bipartite; and the anal rays are iii, 20.

As will be seen from the preceding key, this species stands out quite distinctly from the other local forms.

Genus CULTROPS H. M. Smith

Cultrops H. M. Smith, Journ. Washington Acad. Sci., vol. 28, p. 410, 1938. (Type, *Culter siamensis* Hora.)

The genus *Cultrops* was established (1938c) for fishes that had previously been placed in the genus *Culter* of Basilewsky (1855), the latter name being regarded as a synonym of *Pelecus*, established by Agassiz (1836) for the Linnaean species *Cyprinus cultratus*. It is the present writer's view that Basilewsky intended to indicate and did indicate *Cyprinus cultratus* as the type of his genus, this view being supported by the opinion of numerous colleagues to whom this nomenclatorial question was submitted. It is, of course, recognized that Basilewsky did not in so many words designate *Cyprinus cultratus* as the genotype. At that period it was not the practice to indicate the types of fish genera, but it was the obvious intent of that author, in devoting a full line to "*Cypr. cultratus* Linn." immediately after the first mention of the name *Culter*, to make it known that the new Asiatic fishes that he was describing were typified by a well-known European fish. If a different view is held by some ichthyologists, the matter will no doubt in time be referred to and adjudicated by the International Commission on Zoological Nomenclature [when it functions again after the second world war].

CULTROPS SIAMENSIS (Hora)

Culter siamensis Hora, 1923b, p. 149, pl. 10, fig. 1; pl. 11, figs. 4, 5 (Menam Chao Phya at Bangkok).—Fowler, 1935a, p. 109 (Bangkok); 1937, p. 163 (Bangkok). (Species by error credited to Günther.)

Culter wolfii Fowler, 1937, p. 163, fig. 101 (Pitsanulok, Mepoon).

Cultrops siamensis Smith, 1938c, p. 410 (Siam).

The type specimen came from the Menam Chao Phya at Bangkok. The fish has now been found throughout that river from Paknampo to near its mouth; in Bung Borapet and its outlets; in the Nan River near its confluence with the Chao Phya at Paknampo; in the Pasak River both above and below the barrage at Dha Luang; in the Nakon Nayok River; and at various places in the Meklong. It also frequents the larger canals.

The maximum size represented in the collections and records of the Thailand Fishery Service was 23.5 cm. over all, 20.5 cm. to the base of the caudal fin. This was a specimen taken February 27, 1925, in the Pasak River at Dha Luang. Fish 14 to 20 cm. long are common.

The fish may be rated as common to abundant. It often goes in scattered schools, and when it comes to the surface may be readily recognized by the narrow black margin of the posterior border of the caudal fin.

C. siamensis is the genotype of *Cultrops*. The species was described in detail by Hora, and a good figure was given by him. Among the outstanding features are the strongly compressed body and head, nearly straight and horizontal dorsal profile, trenchant abdominal edge, subvertical mouth, strongly developed symphyseal hook on the lower jaw and correspondingly deep emargination on the upper jaw, triserial pharyngeal teeth (4, 4, 2), long setiform gill rakers numbering 23 to 26 on the lower arm of the first arch, tripartite natatory vesicle, small scales (about 90 in lateral series, 12 to 15 above lateral line, 5 to 7 between line and base of ventral fin, 55 to 60 predorsal), lateral line often (perhaps usually) consisting of 2 or 3 disconnected and overlapping parts, dorsal fin inserted over the space between the ventral and anal fins and consisting of 7 branched rays and 2 slender nonosseous simple rays, and long anal fin with 23 to 25 branched rays.

In the arrangement of three overlapping lateral lines, as exhibited by the type, the uppermost section beginning at the upper angle of the gill opening may extend over 20 to 30 scales to a point in advance of or over the base of the ventral fins; the middle section, the shortest, may cover 18 to 20 scales, beginning over the middle of the pectoral fin and extending to the ventral, the anterior 15 scales overlapped by the uppermost section; the lowermost section, always the longest, begins over the pectoral fin and extends to the base of the caudal fin, its anterior 10 to 15 scales overlapped by the uppermost section.

As pointed out by Hora (1923b) in the first account of *Culter siamensis*, his single specimen, 17.5 cm. long, without caudal fin differed in several important features from the generally recognized definition of *Culter*, and he suggested that the differences were sufficient to distinguish the new species generically from *Culter*. At that time he was dissuaded from establishing a new genus because of the paucity of material for the study of individual variation.

It is believed that *Culter wolfii* will prove to be this species. In squamation, gill rakers, teeth, fin rays, and other features there is almost perfect agreement. The only character mentioned by Fowler as distinguishing *wolfii* from *Cultrops siamensis* is the length of the pectoral fins. This feature, however, is variable, and the variation seems to cover *Culter wolfii.* While in Hora's type specimens the pectorals were a little less than the head in length and in *C. wolfii* are appreciably longer than the head, in many specimens from the type locality of *Cultrops siamensis* the pectorals have been found to be longer than the head and reach the base of the ventrals, and in others from the same place, taken at the same time, the pectorals have not exceeded the length of the head.

The usual vernacular name given to this fish is *pla tong plu.* In some parts of Thailand the fish shares with *Paralaubuca* the name *pla paep.* On the Nakon Nayok River a designation sometimes used is *pla paep kwai* (*kwai*, water buffalo), probably in allusion to its larger size as compared with *Paralaubuca.*

Genus PARACHELA Steindachner

Parachela STEINDACHNER, Sitzb. Akad. Wis. Wien. math-nat. Cl., vol. 83, p. 404, 1881. (Type, *Parachela breitensteini* Steindachner.)

PARACHELA WILLIAMINAE Fowler

Parachela williaminae FOWLER, 1934a, p. 111, fig. 63 (Mekong at Chiengsen).

The genus *Parachela*, characterized by the absence of ventral fins, was known from a single species from Borneo until R. M. de Schauensee, on February 10, 1933, in the Mekong at Chiengsen, Northern Thailand, made the surprising capture of a specimen 10.8 cm. long, which represented a species differing from Steindachner's type in such characters as squamation and number of anal rays. Only a single specimen is known. In addition to having no ventral fins, this species is characterized by the insertion of the dorsal fin entirely over the anal, by the very long anal (with 35 branched rays), and by the long pectoral, which extends past the origin of the anal.

Subfamily RASBORINAE

This subfamily is rather numerously represented by both genera and species in the fresh waters of Thailand, and individuals of various species may be abundant. In most of the genera the fish are too small to have a direct economic value to man, but in several genera, and especially in *Luciosoma*, there are species whose size entitles them to consideration in the markets. The following key will separate the genera represented in Thailand:

a. One pair or two pairs of barbels (rostral and maxillary); symphyseal knob on lower jaw present or absent.
  2*a.* No symphyseal knob; maxillary barbels very long, rostral barbels short; branched anal rays 5 -- **Esomus**

- 2*b*. Symphyseal knob present; barbels well developed, short, or rudimentary.
  - 3*a*. Branched anal rays 6 to 17; origin of dorsal fin far posterior to midlength of fish.
    - 4*a*. Mouth small or medium, maxillary not extending beyond vertical from anterior border of eye; branched anal rays 8 or more. Size small.
      - 5*a*. Lateral line complete; branched dorsal rays 8 to 12; pharyngeal teeth in 2 rows; a shelf extending backward from lachrymal bone. Daniops
      - 5*b*. Lateral line complete, incomplete, or absent; branched dorsal rays 7 to 17; branched anal rays 10 to 17; pharyngeal teeth in 3 rows; no shelf on lachrymal bone________________ Danio
    - 4*b*. Mouth large, maxillary extending to below eye; branched anal rays 6. Size rather large________________ Luciosoma
  - 3*b*. Branched anal rays 5; origin of dorsal fin anterior to midlength of fish. Filirasbora
- 1*b*. No barbels; symphyseal knob present; branched anal rays 5______ Rasbora

Genus ESOMUS Swainson

Esomus SWAINSON, The natural history of fishes, vol. 2, pp. 185, 285, 1839. (Type, *Esomus vittatus* Swainson=*Cyprinus danrica* Hamilton.)

Small fishes of minor fresh waters with profuse vegetation, easily recognized by a pair of very long, slender maxillary barbels. The pharyngeal teeth are in a single series. Three species are ascribed to local waters, one of them doubtfully:

- 1*a*. Lateral line piercing only 4 to 6 scales anteriorly; rostral barbel extending beyond eye; a broad black band from eye to base of caudal fin____ danrica
- 1*b*. Lateral line piercing 11 to 18 scales and extending to ventral or anal fin.
  - 2*a*. Rostral barbel reaching well behind eye; a narrow dark gray line from head to base of caudal fin________________ goddardi
  - 2*b*. Rostral barbel reaching to middle of eye; a black band from eye to base of caudal fin, always distinct posteriorly________________ metallicus

ESOMUS DANRICA (Hamilton)

Cyprinus danrica HAMILTON, 1822, pp. 325, 390, pl. 16, fig. 88 (Bengal).

Fowler (1934a, 1935a) recorded this fish from Northern, Central, and Southeastern Thailand, but he gave no description of his specimens. The Academy of Natural Sciences of Philadelphia, through Mr. Fowler, courteously sent to the U. S. National Museum three specimens collected by R. M. de Schauensee at Bangkok in May 1934, which had been identified as this species. *E. danrica* is marked, among other characters, by an incomplete lateral line that pierces only 4 to 6 of the anterior scales and by a broad black band extending from behind the eye to the base of the caudal fin. In the three specimens cited the lateral line is somewhat variable, extending over 12 to 18 scales, and reaches beyond the ventral fins or to a point over the anterior part of the anal fin; and the longitudinal band is represented by a narrow dark stripe most distinct posteriorly. It is believed that these specimens do not represent *E. danrica* but that they belong in *E. goddardi.*

It is probable that the references of Bleeker and Károli to this species in Thailand are incorrect and should apply to *E. metallicus.* The writer's own very extensive collecting in all parts of Thailand yielded no specimens that could be referred to *danrica*, a well-known Indian species.

ESOMUS GODDARDI Fowler

Esomus danrica Fowler, 1934a, p. 113 (Chiengmai, Metang) ; 1935a, p. 110 (Bangkok, Sriracha).

Esomus goddardi Fowler, 1937, p. 170, fig. 106 (Mepoon, Pitsanulok, Tachin, Bangkok, Kemarat).

This fish is common in Central Thailand. In addition to the record for Kemarat on the Mekong, there are in hand specimens from a roadside pool at Kumpawapi, Udon, February 27, 1929. Identifiable as this species are five specimens collected by the writer January 4, 1926, from a pool at Angkor Wat, Cambodia.

A length of 8.5 cm. is attained. In a specimen 5.4 cm. long from a ditch at Nontaburi above Bangkok, the lateral line terminates slightly posterior to the midbase of the anal fin.

The characteristics of the species are an incomplete lateral line which may extend only to the ventral fin but usually reaches the anal, a long rostral barbel extending well behind the eye, a long maxillary barbel extending to or beyond the origin of the anal fin, and a dark gray line along the side from the head to the base of the caudal fin.

Examples from Bangkok referred to *E. danrica* by Fowler (1935a) appear to belong to this species, having the lateral line extending to the ventral or anal fin. Various specimens from Northern Thailand collected by Deignan have the rostral barbel not extending beyond the eye but are otherwise referable to *E. goddardi.*

ESOMUS METALLICUS Ahl

Figure 5

Nuria danrica von Martens, 1876, p. 403 (nomen nudum) (Petchaburi).—?Sauvage, 1881, p. 164 (nomen nudum) (Siam).—Károli, 1882, p. 180 (Siam).

Esomus metallicus Ahl, 1924, p. 42 (Petchaburi).—Hora and Mukerji, 1928, p. 54, fig. 4 (Nontaburi, Nong Khor).—Smith, 1934a, p. 80, fig. (Siam).—Fowler, 1937, p. 170 (Rayong) ; 1939, pp. 40, 67 (Huey Yang, Trang).

Esomus danrica Bleeker, 1865 (347), p. 35 (Siam) ; 1865 (356), p. 176 (Siam).

Described from Petchaburi, probably from the Petchaburi River, in the Southwestern part of Central Thailand, this species has since been found in various other parts of the Central region and in the Peninsular and Southeastern area. It occurs throughout the Menam Chao Phya and it is especially common in the Bangkok district.

In the Southeastern district it is very common in Nong Khor and has been collected in a small tributary of the Krat River on Kao Seming and in rivulets on Kao Sabap.

The species shows considerable variation within certain limits. Thus, the maxillary barbel may extend only to the base of the ventral fins in some specimens, to the ventral opening in others, and to or beyond the base of the anal fin in others; and the lateral line, which does not usually continue as far as the base of the anal fin and may not reach the base of the ventrals, in a specimen 7.1 cm. long from the Menam Chao Phya, at Paknam, terminated on one side on a scale above the origin of the anal fin and on the other side above the base of the ventrals; in a female 7.2 cm. long from the Menam Chao Phya at Paknam it terminated on one side on a scale above the origin of the anal fin and on the other side above the base of the ventrals; and in a female 7.2 cm. long, with ripe eggs, taken in a ditch in Bangkok May 26, 1925, there was no lateral line on either side. The black lateral stripe is usually quite distinct, extending from behind the eye to the base of the caudal fin, but it may be indistinct anteriorly.

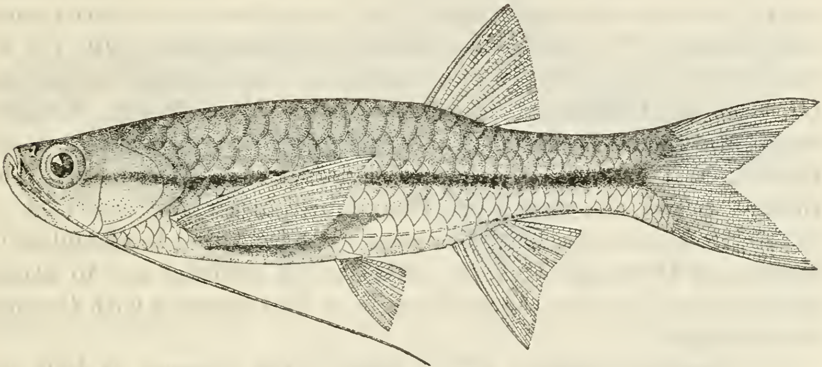


Figure 5.—*Esomus metallicus* Ahl. Drawn by Luang Masya; courtesy of the Thailand Government.

This is one of the most abundant of the small cyprinid fishes. Its favorite haunts are weedy ditches and drains connected with large streams. It makes an excellent aquarium fish, easily adapted to confinement in small vessels and remaining active and hardy on a diet of mosquito larvae and small crustaceans.

The fish has received no special vernacular name and is apparently not distinguished by fishermen from other small cyprinids.

DANIOPS, new genus

Similar to *Danio* in having a complete lateral line, but differs in having a reduced number of branched dorsal rays, a shelf extending backward from the lachrymal bone, and pharyngeal teeth in two rows.

Mouth small, oblique; lower jaw with a moderately developed symphyseal knob; rostral barbels well developed, maxillary barbels minute, rudimentary, or lacking; pharyngeal teeth long, slender, uncinate, biserial, with five teeth in main row and four in second row; gill openings wide, extending under eye; gill membranes connected with isthmus; gill rakers short and comparatively few; lateral line descending abruptly over basal part of pectoral fin and running thence near the ventral profile to the lower half of the base of the caudal fin; dorsal fin placed far backward, its origin in advance of anal and nearer to caudal base than to tip of snout, branched dorsal rays 8; caudal fin forked; anal rays usually 11 or 12, sometimes 8 to 10; ventral fins short, inserted far in advance of dorsal.

Genotype.—Daniops myersi, new species.

This genus may be found to intergrade with *Danio* of Hamilton and to have only subgeneric rank. Although *Danio* in the strict sense as set off from *Brachydanio* by Weber and de Beaufort (1916, vol. 3) was credited with 12 to 16 branched dorsal rays, species are known [*D. dangila* (Hamilton), *D. aequipinnatus* (McClelland), *D. malabarica* Masya and Indrambarya, *D. neilgherriensis* (Day), *D. regina* Fowler, etc.] in which the branched dorsal rays are 9 to 11. The Indian species *D. naganensis* Chaudhuri, originally described as having 10 dorsal rays, has 9 branched rays according to Chaudhuri's figure, and Hora and Mukerji (1934) in an artificial key to *Danio* give the dorsal rays for the species as iii, 8, thus agreeing with *Daniops* in this respect.

An outstanding feature of this genus is the presence, in fully developed examples, of a backward-projecting shelf from the lachrymal bone, corresponding with the spine seen in *Danio regina* Fowler and other species. This shelf, as existing in most adults, may be of rectangular shape or may have the two free angles rounded or produced into points.

Another diagnostic feature is the arrangement of the pharyngeal teeth in two rows. This number has been found to exist in all of numerous specimens examined. All the references in the literature to the pharyngeal teeth in *Danio* (Günther, Weber and de Beaufort, Day, etc.), indicate that such teeth are triserial, and this arrangement has been confirmed in various species represented in the collection of the U. S. National Museum.

DANIOPS MYERSI, new species

FIGURE 6

Description.—Dorsal profile from snout to dorsal fin nearly straight, ventral profile moderately convex; depth 3.5 in standard length; least depth of caudal peduncle 1.2 in its length and somewhat less than 0.5

length of head; head 4.3 in length; eye 3 in head, 1.5 in interorbital space, and slightly longer than snout; a narrow bony shelf with rounded ends extending backward from the lachrymal bone; a sharp-edged bony flange extending outward from the supraorbital bones and involving about a fourth of the circumference of the orbital rim; mouth small, very oblique, maxillary extending to vertical from anterior border of eye; symphyseal knob on lower jaw and emargination on upper jaw moderately developed; rostral barbels about 0.5 eye, maxillary barbels minute; pharyngeal teeth in two rows, 5, 4–4, 5, long, slender, hooked; gill rakers on first arch 3+12, short spinous points 0.2 length of gill filaments.

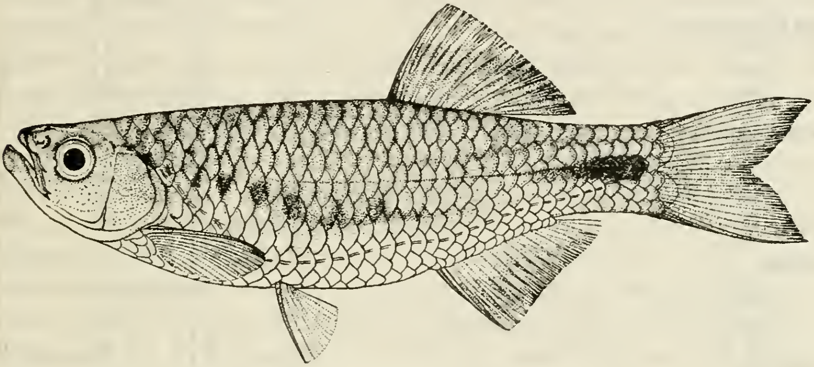


Figure 6.—*Daniops myersi*, new species: Type (U.S.N.M. No. 107961). Drawn by Mrs. Aime M. Awl.

Squamation: Lateral line complete, descending abruptly on first five scales, then dropping to the next lower row, running low over ventral and anal fins and rising on caudal peduncle to a point below midbase of caudal fin; tube-bearing scales 32; scales in transverse series 6.5–1–1.5 to base of ventral; predorsal scales 18; scales surrounding narrowest part of caudal peduncle 12; base of anal covered with thin scales; all scales with conspicuous longitudinal striae.

Fins: Dorsal fin originating slightly before anal, midway between posterior margin of eye and base of caudal fin; dorsal rays ii, 8, longest about 0.75 length of head; caudal deeply forked, as long as head; anal rays iii, 12, the longest less than longest dorsal rays; ventrals 0.5 head; pectoral rays i, 11, the longest equal to head less snout.

Individual variations affect the barbels, squamation, and fin rays. The rostral barbels are fairly uniform in length, but the maxillary barbels may be mere rudiments and have not been observable in some specimens. The tube-bearing scales in the lateral line number 32 to 35. The scales in a transverse series from the midline of the back to the origin of the ventral fin are very constant (6.5–1–1.5), as are the scales surrounding the narrowest part of the caudal peduncle (always 12). The branched rays in the dorsal fin are always 8. The branched rays in the anal fin number 8 to 12, with 11 or 12 predominating. The pectoral rays are i, 10 or i, 11. The variational frequency of some of these features is shown in the following tabulation covering 13 specimens from Thailand and 8 from French Indo-China near the Thailand border:

Character	Specimens from Huey Melao, Northern Thailand	Specimens from Huey Nam Puat, French Laos	Tota
Scales in lateral line:			
32	3	4	7
33	2	4	6
34	6		6
35	2		2
Predorsal scales:			
14	1	1	2
15	3	5	8
16	6		6
17		2	2
18	3		3
Anal rays:			
iii, 8	1		1
iii, 10	1		1
iii, 11	6	2	8
iii, 12	5	6	11
Pectoral rays:			
i, 10	5	7	12
i, 11	8	1	9

Coloration (in preservative): Upper half of body and head light green, the scales with darker edges; belly white; under side of head silvery; seven black quadrate spots along side before dorsal fin, the line of spots being continued backward as a narrow black stripe to a point over midbase of anal fin; posterior half of median line of body with a black band, which is less distinct anteriorly but broadens and becomes jet black on caudal peduncle, this band being separated from the color of the back by a narrow pale yellow stripe, above which is a narrow, indistinct blackish stripe; dorsal anteriorly with a white edge, otherwise dusky; caudal and anal fins dusky; ventrals and pectorals partly dusky.

The highest development of the coloration—with a series of blackish quadrate blotches along the side anteriorly and a black lateral band posteriorly, becoming wider toward the base of the caudal fin—occurs in both sexes. Sexual maturity and ripening of the eggs, however, may not necessarily be associated with the greatest development of the black markings: thus, five of the specimens from Huey Nam Puat, 6.7, 6.8, 6.8, 7.1, and 7.8 cm. long, all approaching the spawning period, do not show the full coloration. All specimens, regardless of the spots along the side anteriorly, have the black along the posterior part of the side, with the pale band above it.

Type and paratypes.—The type (U.S.N.M. No. 107961), a male specimen 7.28 cm. long, was taken August 23, 1934, in Huey Me Lao, a mountain stream on Doi Hua Mot, in Northern Thailand. Paratypes bear the following U.S.N.M. numbers: 107806, 107892, 107921, 108130, 108863, 117725–117728, 119448, 119449, 119525, 119526.

Other specimens.—Five other specimens taken at the same time and place are 5.9 to 8.5 cm. long, and seven others taken August 22 at the same place are 6.9 to 7.7 cm. long. From Huey Nam Puat, a tributary of the Mekong at Ban Nam Puat, in French Laos, just across the boundary from Nan Province in Northern Thailand, H. G. Deignan collected eight specimens on April 26, 1936; these are 6.7 to 8.2 cm. long. This locality is about 140 kilometers east of the point in Northern Thailand where the type and other specimens were obtained.

Apparently referable to *D. myersi* is a series of 25 specimens taken by H. G. Deignan, in December 1936 and January 1937, from the Menam Mao and various brooks tributary thereto and from the Huey Mechan, in the Mekong Basin in Northern Thailand. All the specimens are small and none shows the preorbital shelf. They are assigned to the present species on scale and fin-ray characters, including the possession of 8 branched rays in the dorsal fin, on the biserial pharyngeal teeth, and on the general coloration.

Remarks.—All the specimens from Huey Nam Puat taken in April are females with the eggs approaching ripeness; in those from Huey Me Lae taken in August the sexes are about equally divided and some of the females have well-developed eggs.

This species is named for Dr. George S. Myers, professor of biology in Stanford University and formerly assistant curator of fishes in the United States National Museum, in recognition of his valuable studies of Oriental fishes.

Genus DANIO Hamilton

Danio HAMILTON, Fishes * * * River Ganges, pp. 321, 390, 1822. (Type, *Cyprinus dangila* Hamilton.)

The daniids are small, attractively colored, active fishes of small watercourses; in Thailand they are commonest in mountain rivulets.

In 1916 Weber and de Beaufort (vol. 3) proposed *Brachydanio* as a subgenus of *Danio* for forms having 7 branched dorsal rays and incomplete or absent lateral line, leaving *Danio* in the strict sense for forms with 12 to 16 branched dorsal rays and complete lateral line. Myers, Hora, and others gave *Brachydanio* full generic rank, a course that was justified by material available to them. It is apparent now, however, that a sharp line cannot be drawn between *Danio* and *Bra-*

chydanio and that there is intergradation in the two characters on which the two genera or subgenera have been separated. Thus, *Danio naganensis* Chaudhuri, from India, may have 8 branched dorsal rays, in combination with a complete lateral line; *Danio* (*Brachydanio*) *shanensis* Hora, described from the Shan States of Burma, has 7 branched dorsal rays and normally an incomplete lateral line, but a specimen with practically complete lateral line is recorded by Hora and Mukerji (1934), and a specimen from Northern Thailand with fully complete lateral line is figured by Fowler (1934a, fig. 65) without comment. The species *D.* (*B.*) *shanensis* is aberrant in this respect and seems to be the only one in the *Brachydanio* group in which the lateral line may be either complete or incomplete; all the other Indian, Burman, and Thailand species, about eight in number, conform with the original subgeneric definition, having 7 branched dorsal rays and the lateral line either incomplete (*acuticephalus*, *albolineatus*, *sondhii*), or entirely lacking (*choprae* Hora, *kerri* H. M. Smith, *nigrofasciatus* (Day), *pulcher* H. M. Smith), or either incomplete or absent (*rerio* [Hamilton]). Another species, hereinafter referred to, from Northern Thailand, combines a complete lateral line with 7 branched dorsal rays, and for convenience may be recognized as the type of a new subgenus named below.

The Thailand species of *Danio* fall into three groups, or subgenera, which may be indicated as follows:

Danio in strict sense: Lateral line complete. Branched rays in dorsal fin 8 to 17; branched anal rays 11 to 17; barbels present (maxillary and rostral or only maxillary) or absent; a preorbital spine present or absent.

Brachydanio: Lateral line absent or incomplete. Branched dorsal rays 6 or 7; branched anal rays 10 to 13; barbels present or absent; no preorbital spine.

Allodanio (new subgenus): Lateral line complete. Branched dorsal rays 7; branched anal rays 10; barbels (rostral and maxillary) present; no preorbital spine.

The local species, numbering nine, may be identified by the use of the following key:

1*a*. Lateral line complete.
  2*a*. Branched dorsal rays 8 to 17; branched anal rays 11 to 17. Subgenus DANIO.
    3*a*. Rostral and maxillary barbels present; origin of anal fin well behind origin of dorsal fin.
      4*a*. A small backward-projecting spine on anterior orbital rim.
        5*a*. Body deep, its depth 2.65 to 2.75 in standard length; least depth of caudal peduncle about 1 in its length; origin of anal fin 1 eye diameter behind vertical from dorsal origin; 1 scale between lateral line and base of ventral fin; general color light brown, with 5 pale (blue or white) longitudinal bands on body____________ **regina**
        5*b*. Body more elongate, its depth 3.75 to 4 in standard length; least depth of caudal peduncle about 2 in its length; origin of anal fin 2 eye diameters behind vertical from dorsal origin; 1.5 or 2

scales between lateral line and base of ventral fin; general color yellow, with a broad blue median longitudinal band from head to base of caudal fin and a narrower golden longitudinal band on each side of median one ------------------------ aequipinnatus

4b. No backward-projecting spine on anterior orbital rim; general color silvery, with a blackish longitudinal stripe or band on side beginning below dorsal fin and extending to base of caudal fin; head 3.5 in standard length; mouth oblique, maxillary reaching vertical from anterior margin of eye; scales between midline of back and lateral line 8.5; circumpeduncular scales 14; branched dorsal rays 11, branched anal rays 14 ------------------------ peninsulae

3b. Only maxillary barbels present; origin of anal fin opposite dorsal origin; no backward-projecting spine on anterior orbital rim; 2 scales between lateral line and base of ventral fin; 4 to 6 dark longitudinal bands on side ------------------------ suvatti

2b. Branched dorsal rays 7; branched anal rays 10; both rostral and maxillary barbels present. ALLODANIO, new subgenus ------------------------ ponticulus

1b. Lateral line absent or normally incomplete; branched dorsal rays 6 or 7; branched anal rays 10 to 13. Subgenus BRACHYDANIO.

6a. Lateral line incomplete.

7a. Lateral line extending beyond base of anal fin (exceptionally to base of caudal fin); barbels entirely absent or reduced to a stumpy pair at corners of mouth; 5 to 10 dark cross bands on anterior part of body and a dark longitudinal band thence to caudal fin ------------------------ shanensis

7b. Lateral line ending before base of ventral fins; two well-developed pairs of barbels; a scarlet band extending in brown of side from base of caudal fin to a point under or before dorsal fin ------------------------ albolineatus

6b. Lateral line entirely absent.

8a. Maxillary barbel extending slightly beyond gill opening; rostral barbel reaching behind eye; back reddish; on side and opercle a broad dull blue band within which are 4 bright scarlet narrow longitudinal stripes, one from gill opening to caudal base; dorsal and caudal fins dusky, with pale red edges; anal fin dusky, the rays pale red ------------------------ kerri

8b. Maxillary barbel extending far beyond base of pectoral fin; rostral barbel reaching beyond preopercle; back and sides with longitudinal bands and stripes of blue, orange, and orange-red; dorsal fin green basally, chrome yellow distally, with a broad vermilion margin; caudal fin pale green with central part and posterior margin scarlet; anal fin scarlet at base, distal half chrome-orange with a narrow sky-blue edge, a deep green median band ------------------------ pulcher

DANIO (DANIO) REGINA Fowler

Danio malabarica MASYA and INDRAMBARYA, 1932, p. 280 (Koh Samui).

Danio regina FOWLER, 1934b, p. 342, fig. 6 (Nakon Sritamarat).—MYERS, *in* Herre and Myers, 1937, p. 56 (Chong waterfall stream).—FOWLER, 1939, p. 67 (Trang).

In a fish collection from the Trang district of Peninsular Thailand, Fowler (1939) found over a hundred specimens of this species, the largest 12.5 cm. long. Specimens taken in the same locality in 1932 have a conspicuous black spot as large as the pupil in a pale circular area just behind the upper end of the gill opening; this spot, only faintly suggested in Fowler's drawing, is not referred to in his description.

Described from two specimens, 8 and 7.4 cm. long, taken in 1933 in Nakon Sritamarat, Peninsular Siam, an outstanding feature of this species is a preorbital spine that projects backward from the lachrymal bone. In general appearance it greatly resembles *D. malabarica* of India and Ceylon but seems to have a somewhat different pattern of longitudinal stripes. Fowler made the species the type of a new subgenus, *Rambaibarnia*, distinguished by the presence of a preorbital spine.

It seems probable that all specimens from Thailand formerly identified as *D. malabarica* in reality represent *D. regina.* These specimens have come from a waterfall stream on Koh Samui in the Gulf of Siam as noted by Masya and Indrambarya (1932); from a brook in Ronpibun; from Klong Sok, one of the upper branches of the Tapi River southwest of Bandon; and from a waterfall stream on Kao Chong near Trang. An examination of specimens from these localities in the Thailand Bureau of Fisheries has disclosed in all of them a preorbital spine, which is supposed to be a distinguishing character in *regina* but lacking in *malabarica*, although Vinciguerra (1889–90, p. 303) reported the presence of this spine in Burmese fish that he identified as *malabarica* but that may have been referable to *regina.* From the information now available it is not possible to give *D. malabarica* a Thailand habitat.

On Koh Samui this fish is called *pla siew bai pai* (bamboo-leaf siew fish) and in the Trang-Patalung district *pla chuk ki.* Ordinarily the fishermen do not distinguish between *Danio* and *Rasbora* in applying names.

DANIO (DANIO) AEQUIPINNATUS (McClelland)

Perilampus aequipinnatus McClelland, 1839, p. 393, pl. 60, fig. 1 (Assam).
Danio aequipinnatus Hora, 1923, p. 153 (Nakon Sritamarat).

This species, well distributed in India and known also from Burma and Ceylon, has been found in Thailand in a mountain stream in Nakon Sritamarat, whence Hora had two specimens. The writer's collecting in the same general region failed to disclose this species.

It was first pointed out by Vinciguerra (1889–90, p. 304) and later confirmed by Myers (in Herre and Myers, 1937, p. 57) that in this species there is a preorbital spinous process as in *D.* (*D.*) *regina.*

DANIO (DANIO) PENINSULAE, new species

Figure 7

Description.—Depth 3.5 in standard length; least depth of caudal peduncle 1.5 in its length and more than 2 in head; head almost equal to depth, its upper profile straight; eye 3 in head, exceeding snout and 2 times interorbital space; posterior end of maxillary reaching vertical from anterior margin of eye; symphyseal hook of lower jaw and emargination of upper jaw moderately developed; rostral barbel 0.6 eye, maxillary barbel 0.25 eye.

Squamation: Lateral line complete, covering 31 scales; 8.5 scales above lateral line and 1 below lateral line to origin of ventral fin; predorsal scales 14; scales surrounding caudal peduncle 14; 9 scales between lateral lines counted over back in narrowest part of caudal peduncle.

Fins: Origin of dorsal fin about two-thirds eye diameter in advance of vertical from origin of anal, rays iii, 11, longest branched ray 1.5 in head; caudal fin deeply emarginate, a trifle longer than head; anal fin emarginate, iii, 15, rays, the longest equal to dorsal; ventrals 1.5 in head; pectorals extending beyond ventral base, 0.8 length of head.

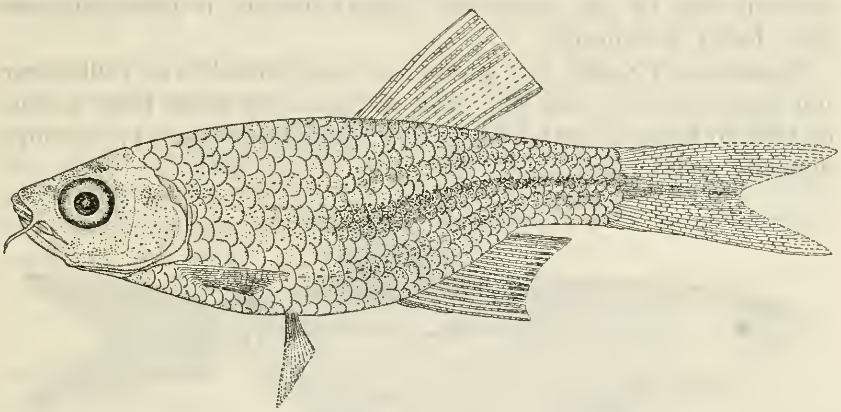


FIGURE 7.—*Danio (Danio) peninsulae*, new species: Type (U.S.N.M. No. 107962). Drawn by Mrs. Alice C. Mullen.

Coloration: Silvery; back light green, caudal peduncle pale orange-yellow; a narrow, well-defined blackish longitudinal band beginning under dorsal fin, extending to base of caudal, and continuing on middle caudal rays; fins otherwise plain.

Type and paratypes.—The type (U.S.N.M. No. 107962) is 4.7 cm. long and was taken July 20, 1928, from a brook at an elevation of 300 meters at the base of Kao Luang, Nakon Sritamarat, Peninsular Thailand. Two other specimens obtained at the same place and time were 4.4 and 3.2 cm. long (paratypes, U.S.N.M. No. 108131).

DANIO (DANIO) SUVATTI Fowler

Danio suvatti FOWLER, 1939, p. 67, fig. 16 (waterfall at Trang).

In a waterfall stream on Koh Chong, near Trang, in Peninsular Thailand, four specimens of a *Danio* taken in October 1936 were described by Fowler as a new species, characterized by a single pair of short (maxillary) barbels, insertion of ventral fins practically opposite the origin of the dorsal, and peculiar coloration.

The type is 5.9 cm. long and the paratypes are 2.8 to 4.4 cm. long.

DANIO (ALLODANIO) PONTICULUS, new species

Figure 8

Description.—Body and head rather strongly compressed; depth of body 4.2 in standard length and 2.3 times its width at shoulder; depth of caudal peduncle about 0.5 its length and less than 0.5 length of head; head pointed, its length equal to depth of body; eye about 3 in head; snout 0.8 eye; interorbital space 1.25 in eye; rostral barbels 0.6 eye, maxillary barbels 0.2 eye; maxillary reaching vertical from anterior edge of eye; lower jaw slightly longer, its postsymphyseal knob feebly developed.

Squamation: Scales with prominent longitudinal striae; tube-bearing scales in lateral line 31; scales in transverse series from midline of back to base of ventral fin 6.5–1–1; predorsal scales 14; circumpeduncular scales 12.

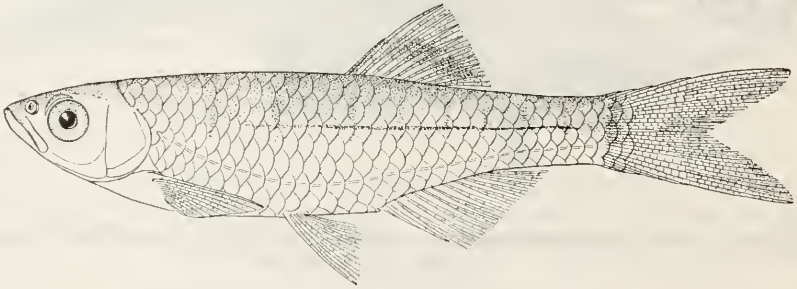


Figure 8.—*Danio (Allodanio) ponticulus*, new species: Type (M.C.Z. No. 35524). Drawn by Mrs. Aime M. Awl.

Fins: Origin of dorsal fin midway between posterior edge of orbit and base of caudal fin, rays ii,7, longest ray 1.2 in head; caudal fin longer than head, forked for half its length, the lobes pointed; anal fin arising under base of fourth branched dorsal ray, its rays ii,10, longest ray 1.8 in head; ventral rays i,7, 1.4 in head, reaching anal opening; pectoral rays i,10, 1.3 in head, not reaching base of ventrals.

Coloration: Silvery; a black line along side from a point over pectoral fin to base of caudal; dorsal rays basally dusky green; other fins plain.

Type.—The type (M.C.Z. No. 35524), 7.5 cm. long, was collected by the Harvard Primate Expedition April 27, 1937, at Chiengmai, presumably in the Meping, Northern Thailand.

Remarks.—This new species, *Danio* (*Allodanio*) *ponticulus*, type of the new subgenus *Allodanio*, bridges the gap between *Danio* and *Brachydanio*, having a complete lateral line and seven branched dorsal rays.

(*Ponticulus*, a little bridge.)

DANIO (BRACHYDANIO) SHANENSIS Hora

Danio (*Brachydanio*) *shanensis* HORA, 1928, p. 38 (Namkhan, Kutaki, Lashio, Hsipaw, Northern Shan States).

Danio shanensis FOWLER, 1934a, p. 113, fig. 65 (Chiengmai, Metang).

This species was described in 1928 from the Northern Shan States of Burma where it was found to be common in ricefields, in small ponds, and in pools in the bed of hill streams. It was subsequently reported from the Southern Shan States, and in the same year Fowler noted over 130 specimens from Chiengmai and the Metang north of Chiengmai. The lateral line is variable. In the material from the Shan States the lateral line is normally deficient posterior to the base of the anal fin, although in one specimen Hora found the lateral line practically complete. The figure published by Fowler shows the lateral line uninterrupted and extending to the base of the caudal fin. The barbels are given as either entirely absent or a short, stumpy maxillary pair.

The maximum length of Thai examples is 7 cm.

DANIO (BRACHYDANIO) ALBOLINEATUS (Blyth)

Nuria albolineata BLYTH, 1860b, p. 163 (Tenasserim).

Danio albolineata MASYA and INDRAMBARYA, 1932, p. 280 (Koh Samui).

Previously known from Sumatra and Burma, this species has been found to occur in certain mountain brooks in Peninsular and Southeastern Thailand. It was first collected by Luang Masya Chitrakarn in 1927 in a pool below a waterfall on Kao Sabap, four specimens being taken. In 1931 two specimens were obtained by Masya and Indrambarya below the Na Muang waterfall on Koh Samui. From a brook on Koh Chong five specimens were obtained in 1933, the smallest example, 2.1 cm. long, having the characteristic scarlet longitudinal band extending from the base of the caudal fin to the head; this band usually extends only to a point under or slightly in advance of the origin of the dorsal fin.

In Burma a length of 5 cm. is reported by Day. The largest Thailand examples have been 4.2 cm. long.

DANIO (BRACHYDANIO) KERRI H. M. Smith

FIGURE 9

Danio kerri SMITH, 1931a, p. 6 (Koh Yao Yai).

This species, which is very strikingly colored, is known only from the type, 4.2 cm. long, and three other specimens, 3.2, 3.5, and 3.6 cm.

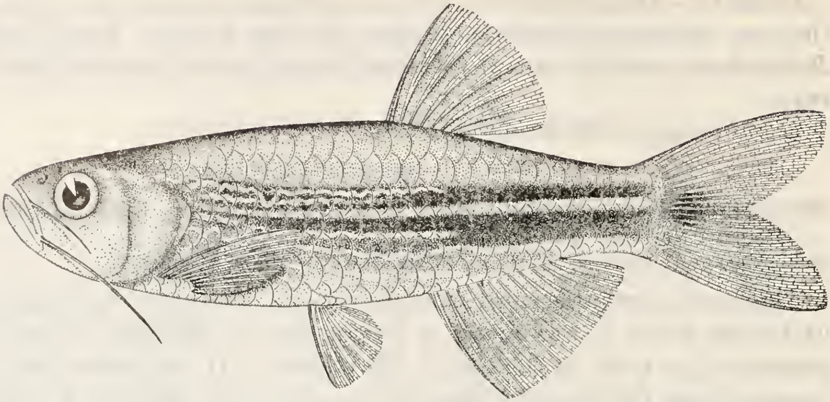


Figure 9.—*Danio* (*Brachydanio*) *kerri* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

long, collected by Dr. A. F. G. Kerr in 1929 on Koh Yao Yai, an island in the Bay of Bengal off the west coast of Peninsular Thailand. The two largest specimens are males, with a profuse development of pearl organs on the head.

DANIO (BRACHYDANIO) PULCHER H. M. Smith

Danio pulcher Smith, 1931a, p. 8 (Chantabun Province).—Fowler, 1937, p. 169, fig. 105 (Pitsanulok, Mepoon).
Danio albolineata Fowler, 1934a, p. 113 (Chantabun).

Originally taken in 1925 in the waterfall brook at Pliew, on Kao Sabap, Southeastern Thailand, this fish has since been reported by Fowler from Pitsanulok and Mepoon, Central Thailand, and also from Chantabun (as *Danio albolineata*). In the upper part of the mountain brook at Pliew the fish was found where the water flows over and among boulders and between banks with dense vegetation.

The largest specimen obtained was a female with ripe eggs, 37.5 mm. long; the others were males, 30 to 32.5 mm. long. Fowler reports specimens up to 50 mm. long at Mepoon.

Genus LUCIOSOMA Bleeker

Luciosoma Bleeker (136), Nat. Tijdschr. Nederl.-Indië, vol. 9, pp. 258, 263, 1855. (Type, *Barbus setigerus* Cuvier and Valenciennes.)

These fishes, with a form suggestive of the pikes, are the largest local members of the subfamily Rasborinae. They bear distinctive vernacular names and are easily recognized by their elongate body, straight dorsal profile, pointed head, large mouth, strong symphyseal hook on the lower jaw, well-developed barbels, posterior position of dorsal and anal fins, deeply forked caudal fin, coloration, and similar characters. Three species are reported from Thailand, distinguished as follows:

1*a*. Pectoral fins extending far beyond base of ventrals; a longitudinal series of blackish brown spots extending from head to base of caudal fin; a dark band across dorsal and anal fins; median and submarginal dark longitudinal bands on caudal fin-- spilopleura

1*b*. Pectoral fins extending to base of ventrals; a black or dark brown longitudinal band on side of body.

  2*a*. A black band from snout to base of caudal fin (band may be made up of spots in young) an inframarginal black band on each caudal lobe; origin of dorsal fin over twenty-third or twenty-fourth scale of lateral line; base of last dorsal ray over base of fourth or fifth branched anal ray; narrowest part of peduncle surrounded by 12 scales---------------- setigerum

  2*b*. A dark band from head to base of caudal fin, extending on median caudal rays to their posterior end; no inframarginal dark band on each caudal lobe; origin of dorsal fin over twentieth or twenty-first scale of lateral line; base of last dorsal ray over base of first or second branched anal ray; narrowest part of caudal peduncle surrounded by 16 scales----- bleekeri

LUCIOSOMA SPILOPLEURA Bleeker

Luciosoma spilopleura BLEEKER 1855 (136), p. 265 (Lahat, Sumatra).
Luciosoma (*Luciosoma*) *spilopleura* BLEEKER, 1865 (356), p. 176 (Siam).—SAUVAGE, 1881, p. 164 (Siam and Sumatra).

Long known from Borneo and Sumatra, this species was recorded also from Thailand by Bleeker in 1865. There has been no other published reference to the fish in Thailand except Sauvage's, probably after Bleeker, and it must be very rare in that country. Two specimens, 24.5 cm. long, taken February 15, 1928, in Tonburi, Bangkok, in a pond connected with the Menam Chao Phya agree in most structural characters with Bleeker's description but show some color differences from his description and plate; they are noteworthy because of a broad leaf-like expansion of the upper and lower lips.

LUCIOSOMA SETIGERUM (Cuvier and Valenciennes)

Barbus setigerus CUVIER and VALENCIENNES, vol. 16, p. 203, pl. 469, 1842 (Pébak River, Java).
Luciosoma setigerum HORA, 1923b, p. 153 (Bangkok, Nontaburi).
?*Luciosoma harmandi* FOWLER, 1935a, p. 110, fig. 45 (Bangkok).

This common species of Java, Borneo, Sumatra, and Malacca was first shown to be an inhabitant of Thailand by Hora in 1923. The writer's own collections, beginning in 1923 and continuing through 1934, showed this fish to be widely distributed and at certain places and times abundant. Localities represented by the collections made for the Siamese Bureau of Fisheries are Bangkok, Nontaburi, Hangkraben, and Paknampo in the Menam Chao Phya; Chiengmai in the Meping; in the lower Menam Nan; at Chiengrai in the Mekok; and at Payao in the large swamp-lake of that name in north-central Thailand.

A length of 25 cm. is attained.

The figure called *L. harmandi* (Fowler, 1935a) based on an undescribed specimen, 17.8 cm. long, from Bangkok, showing a lateral stripe formed largely of dark spots and having a dark submarginal band on each caudal lobe, strongly resembles examples of *L. setigerum* and does not agree in these respects with Sauvage's imperfect description of *L. harmandi;* the figure furthermore shows 36 to 37 scales in the lateral line against 45 given by Sauvage.

The fish shares with other species of the genus the name *pla ai ao.* In Northern Thailand, however, in the Chiengmai and Chiengrai districts, the name is shortened *pla ao.* The term *ai ao* means a worthless fellow, a scamp, and is applied to criminals.

LUCIOSOMA BLEEKERI Steindachner

Luciosoma bleekeri STEINDACHNER, 1879, p. 391 (Menam Chao Phya at Bangkok).
Luciosoma harmandi SAUVAGE, 1880, p. 231 (Laos, Indo-China) ; 1881, p. 188, pl. 6, fig. 4 (Laos, Indo-China).—FOWLER, 1934a, p. 115 (Bua Yai, Chiengmai) ; 1937, p. 173 (Pitsanulok, Kemarat).

This is a common fish throughout the Menam Chao Phya, from Bangkok to Paknampo, and in various tributaries of that stream, including the Meping at Chiengmai. In addition to many specimens examined from the main stream, the collections include examples from the Meyom in Prae Province, the Mesoi in Lampang Province, and Bung Borapet and its outlets into the Menam Nan. Other streams from which the fish has been examined are the Nakon Nayok and the Meklong at Kanburi, in which latter river it is very abundant.

The usual length of adult fish is 15 cm. Examples up to 20 cm. are sometimes taken, and a maximum of 25 to 26 cm. is occasionally attained.

The British Museum collection contains various specimens of this form (labeled *L. harmandi*) from Thailand: four specimens, from the Menam Chao Phya, presented by the Siamese Museum; one specimen received from the late Prince Chumporn; one specimen, from "Western Siam," collected by C. Bock; and two specimens collected by Arthur Vernay in the Mewang, Central Thailand.

Luciosoma harmandi, described by Sauvage in 1880 from Laos, Indo-China, seems to have no characters separating it from *L. bleekeri*, described from Thailand in the previous year. Proportions, squamation, and fin rays are the same in the two forms, the only differences brought out in the descriptions being of a minor nature and affecting chiefly markings on the caudal fin. With the information available from the published descriptions, and with the material at hand, the conclusion seems justified that *L. harmandi* is a synonym of *L. bleekeri.* Steindachner wrote:

> This species is very closely related to *Luciosoma setigerum* Blkr. from the rivers of Java and Sumatra, but the lateral line extends through 46–47 scales (43 in *L. setigerum*) and the first ventral ray is considerably shorter than in the last-named species. In *L. bleekeri* the dark band on the upper and lower caudal next to the upper and lower margins is missing while a central band is present as a direct continuation of the lateral band.

In the description of Weber and de Beaufort and in specimens at hand the black lateral band is continued as the band on the upper caudal lobe, but in the figure of *L. setigerum* in Bleeker (301) (1863, vol. 3, pl. 142, fig. 2) the two bands are not connected and are on different levels.

While the fish is usually known as *pla ai ao* among the Thai, that name is frequently shortened to *pla ao.* Another variant, on the Nakon Nayok, is *pla siew ao.*

Genus FILIRASBORA Fowler

Filirasbora Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 172, 1937. (Type, *Filirasbora rubripinna* Fowler.)

FILIRASBORA RUBRIPINNA Fowler

Filirasbora rubripinna Fowler, 1937, p. 172, fig. 107 (Kemarat).

Known from a single specimen 8.5 cm. long, taken in the Mekong at Kemarat. This is a rasboridlike fish but differs from all species of *Rasbora* in having two pairs of short barbels. The original description made no mention of a symphyseal knob on the lower jaw; this knob is assumed to be present in assigning the genus a place in the key.

Genus RASBORA Bleeker

Rasbora Bleeker (261), Act. Soc. Sci. Indo-Neerl. (Cyprinorum), vol. 7, p. 435, 1860. (Type, *Cyprinus rasbora* Hamilton.)

These are among the commonest of the minor fresh-water fishes in many parts of Thailand. Although mostly small, they have a place in the dietary of the country people, and several species are large enough to be sent to the city markets. Their chief value, however, is as food for the predatory fishes. Several of them, because of their beauty and hardiness, have proved popular in small aquaria both in Thailand and abroad.

The general vernacular name is *pla siew.*

The Thai species may be distinguished as follows:

1a. Lateral line incomplete.
  2a. Lateral line formed of 8 or 9 perforated scales; circumpeduncular scales 9; origin of dorsal fin opposite base of ventrals; a large black triangular patch on side, its base between dorsal and ventrals, its apex toward caudal base -- **heteromorpha**

2b. Lateral line formed of 10 to 23 perforated scales; origin of dorsal fin behind base of ventrals.

3a. Perforated scales in lateral line 10 to 14; circumpeduncular scales 12, a broad black band from head to base of caudal fin_____ borapetensis

3b. Perforated scales in lateral line about 23; circumpeduncular scales 14; a narrow black band from eye to base of caudal fin__________ palustris

1b. Lateral line complete.

4a. Scales between lateral lines over narrowest part of caudal peduncle 9; a broad silvery band from head to base of caudal fin.

5a. Origin of dorsal fin midway between tip of snout and base of caudal fin, over eleventh scale of lateral line; circumpeduncular scales 12; caudal fin with a diffuse dark edge posteriorly______________ argyrotaenia

5b. Origin of dorsal fin midway between tip of snout and posterior half or tip of middle caudal rays, over fourteenth scale of lateral line; circumpeduncular scales 16 (or 14); caudal fin with a sharply defined black edge posteriorly________________________________ retrodorsalis

4b. Scales between lateral lines over narrowest part of caudal peduncle 7.

6a. Origin of dorsal fin before or at middle of line from tip of snout to hindmost scales on caudal base and above or slightly behind origin of ventral fins.

7a. Each caudal lobe with a black subterminal or terminal band; a dark or bluish silvery band from head to base of caudal fin; a dark median dorsal stripe; a dark line on each side over the base of anal fin, the lines uniting behind fin and running medianly on lower side of caudal peduncle_________________________________ trilineata

7b. Caudal fin with a narrow, sharply defined black posterior edge which may be wider on tips of lobes; no dark longitudinal band but a narrow dark longitudinal streak deficient anteriorly and most distinct opposite dorsal and anal fins; no dark line at base of anal fin, no dark median stripe, and no dark spot on caudal peduncle____ layangi

7c. Caudal lobes without a dark subterminal or terminal band; a dark band from head to base of caudal fin, becoming expanded into an oval spot on caudal peduncle____________________________ cromiei

6b. Origin of dorsal fin behind or at middle of a line from tip of snout to hindmost scales on caudal base and always behind origin of ventral fins.

8a. A sharply defined black band from tip of snout to posterior end of middle caudal rays; dorsal and anal fins with a distinct black mark anteriorly; pectoral fins longer than head_____________ einthovenii

8b. A blackish band from head to base of caudal fin; pectoral fins shorter than or equal to head.

9a. Dark longitudinal band rather broad and of uniform intensity throughout; caudal fin posteriorly with a sharply defined black edge widest on tips of lobes; pectoral fins shorter than head____ rasbora

9b. Dark longitudinal band of various extent; pectoral fins shorter than head, rays i,14.

10a. Black longitudinal band may be continuous from head to caudal base or may begin below dorsal; a black median band on back from nape to caudal fin; a round black spot above anterior base of anal fin, may be faint or lacking; scales in lateral line 26 to 30__________________________ lateristriata lateristriata

10*b*. Black longitudinal band narrower and sometimes reduced to a mere line, ending in a round or oval patch on caudal peduncle; a dark spot above base of anal; scales in lateral line in reduced number, to 24________________________ lateristriata sumatrana

10*c*. Black longitudinal band rather narrow and continuous from head to base of caudal fin and expanded at its posterior end; a black median stripe on lower edge of caudal peduncle extending forward on each side of anal base, the caudal stripe sometimes faint or absent, the basal stripe sometimes reduced to an elongate spot over anterior anal rays_________ lateristriata trifasciata

9*c*. Black longitudinal band very faint anteriorly, followed by a round black spot smaller than pupil at base of caudal fin; no dark median dorsal stripe; no median dark stripe on lower edge of caudal peduncle; no stripe or spot above base of anal fin; pectorals as long as head, rays ii,11______________________________ cheroni

RASBORA HETEROMORPHA Duncker

Rasbora heteromorpha DUNCKER, 1904, p. 182 (Kuala Lumpur).—HORA, 1924a, p. 469 (Tale Sap).—SMITH, 1934b, p. 323 (Southeastern Siam).

The occurrence of this diminutive species in the local fauna was first made known by Hora, who reported eight specimens, none over 17 mm. long, from the inner lake of the Tale Sap. The only other known Thailand locality is a mountain stream on Kao Sabap, where the writer has reported specimens taken during 3 years, up to an elevation of 2,000 feet. These fish, 19 to 30 mm. long, show the characteristic coloration. One of the specimens, 30 mm. long, presented to the British Museum, was compared by J. R. Norman with Duncker's types from the Malay Peninsula and found to agree. Males, 30 mm. long, taken July 12, 1928, have nuptial tubercles on the head.

This is one of the most attractive of aquarium fishes and is now well known in America and Europe from examples sent from Singapore.

RASBORA BORAPETENSIS H. M. Smith

Rasbora borapetensis SMITH, 1934b, p. 302 (Bung Borapet).

This is a rather small, very abundant species that has been found chiefly in Bung Borapet but may be looked for in the rivers adjacent to the outlets of the bung. It is readily distinguished from other local species by the incomplete lateral line (which never extends beyond the anal fin and covers at the most 14 scales), by the 12 rows of scales around the narrowest part of the caudal peduncle, by the origin of the dorsal fin well behind the ventrals, and by the coloration: a broad black lateral band bordered above by a narrower golden-green band extending from head to base of caudal fin, carmine basal half of the caudal fin, a dark median dorsal stripe from head to caudal fin, and a black stripe on each side of the anal base continued as a single stripe on the under side of the caudal peduncle. Single specimens taken in the Menam Chao Phya at Nontaburi in September 1924, and in Nong Samet near Chantabun in July 1928, agreed with examples from the type locality.

The maximum size attained appears to be under 5 cm.

Fish taken from Bung Borapet to Bangkok proved active, attractive, and hardy in small balanced aquaria, feeding on mosquito larvae and minute crustaceans. The species should become a popular aquarium fish.

RASBORA PALUSTRIS, new species

Figure 10

Description.—Depth 3.6 in standard length; least depth of caudal peduncle slightly less than its length and 2 in head; head equal to body depth; snout blunt, rounded, gently decurved, 3.5 in head; eye slightly less than snout, 1.5 in interorbital space; mouth small, maxillary not extending to vertical from front margin of eye; symphyseal knob of lower jaw feebly developed.

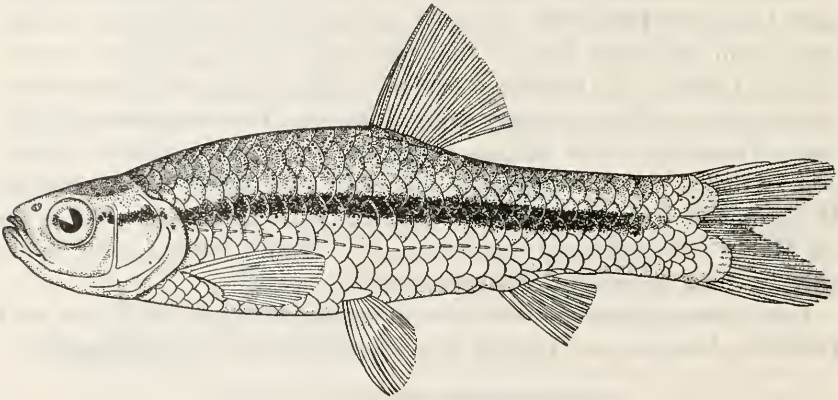


Figure 10.—*Rasbora palustris*, new species: Type (U.S.N.M. No. 107956). Drawn by Miss Jane Roller.

Squamation: Tube-bearing scales in lateral line about 23, extending over posterior base of anal fin; scales between midline of back and lateral line 4.5, a single scale between lateral line and base of ventral fin; predorsal scales 13, circumpeduncular scales 14; thin scales extending far on caudal fin.

Fins: Origin of dorsal fin over eleventh scale of lateral line, posterior to base of ventrals, and somewhat nearer to base of caudal than to tip of snout; dorsal rays ii, 8, longest equal to head less snout; caudal fin about as long as head, deeply forked; anal rays ii, 5, largest 1.5 in head; ventrals rounded, shorter than pectorals, rays ii, 8; pectorals rounded, shorter than head, rays i, 13.

Coloration: Back and top of head pale greenish; lower part of body and head white; lower part of opercle bright silvery; a narrow sharply defined black band from eye to base of caudal fin continued as a faint stripe on median caudal rays; the black band bordered above by a pale golden band from eye to caudal fin, its upper margin on level with upper edge of eye; an indistinct brownish median dorsal stripe from head to caudal base interrupted at dorsal fin; all fins hyaline.

Type.—The type and only known specimen (U. S. N. M. No. 107956) is a male, 5.6 cm. long, with large gonads, taken in Bung Borapet, Central Thailand, December 4, 1932.

Remarks.—With its incomplete lateral line and black longitudinal stripe, this species resembles *R. borapetensis*; its differences, however, are marked, including less pointed head, shorter lower jaw with its tip on level with lower part of pupil (tip of lower jaw on level with upper edge of eye in *R. borapetensis*), more scales around the narrowest part of the caudal peduncle (14 instead of 12), more perforated scales of lateral line (23 instead of a maximum of 14), extension of the black longitudinal band to the eye (instead of its restriction to body), and absence of black lines at base of anal and on underside of caudal peduncle (these conspicuous in *R. borapetensis*).

RASBORA ARGYROTAENIA (Bleeker)

FIGURE 11

Leuciscus argyrotaenia BLEEKER, 1850 (25), p. 21 (Banjumas, Gombong, Purworedjo, and Surabaya, Java).

Rasbora dusonensis BLEEKER, 1859–60 (239), p. 102 (Siam); 1865 (356), p. 176 (Siam).—SAUVAGE, 1881, p. 164 (Siam); 1883b, p. 153 (Menam Chao Phya).

Rasbora argyrotaenia VON MARTENS, 1876, p. 403 (Bangkok).—KÁROLI, 1882, p. 180 (Siam).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 61 (Siam).—HORA. 1923b, p. 152 (Koh Chang); 1924a, p. 469 (Tale Sap).—FOWLER, 1934a, p. 113 (Chiengmai, Chiengsen); 1937, p. 169 (Bangkok, Tachin, Mepoon, Kemarat); 1939, p. 44 (Krabi).

In addition to its wide range in the East Indian Archipelago, this species is known from Malaya and Annam as well as Thailand. It occurs over a large part of the country and in great abundance. Fowler records it for the Meping Basin at Chiengmai and from points on the Mekong on the northern and eastern borders of Thailand; the writer's collecting has disclosed it in the Mekong at Ban Tai, Province of Udon, throughout the Menam Chao Phya from Paknampo to Bangkok, in Bung Borapet, in the Bangpakong, in the Kanburi near Kanburi, in Klong Sao Tong (Nakon Sritamarat), and in Tale Noi. The collections made by Deignan extended the known range to the headwaters of the Nan River. Specimens in the British Museum presented by the Siamese Museum are from the Menam Chao Phya and the upper Bangpakong.

This is the largest of the local rasborids. For the Indo-Australian Archipelago a length of 17 cm. is reported; for Thailand the largest secured are about the same. The females average larger than the males.

Specimens from Thailand labeled *Rasbora dusonensis* obtained from the Paris Museum are in the British Museum. Günther and Weber and de Beaufort considered *R. dusonensis* a synonym of *R. argyrotaenia.*

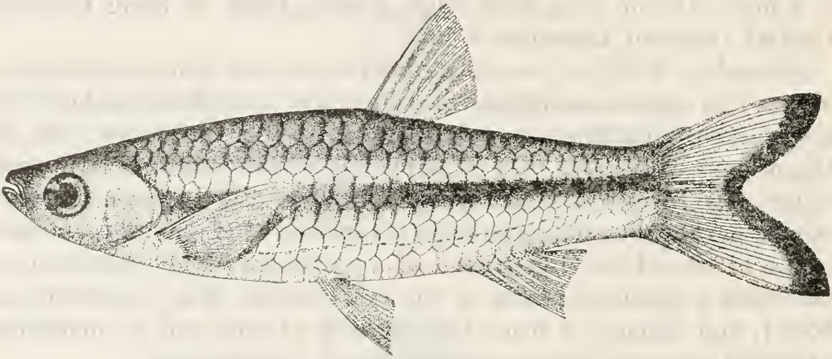


FIGURE 11.—*Rasbora argyrotaenia* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Although Hora (1923b) identified as *R. argyrotaenia* two young specimens collected by Dr. Malcolm Smith in a waterfall stream on Koh Chang, the writer's own very extensive collecting in the streams of that island yielded only *R. lateristriata.*

The common name for this fish throughout Thailand is *pla siew.*

RASBORA RETRODORSALIS, new species

FIGURE 12

Description.—Depth 3.6 in standard length; least depth of caudal peduncle 1.5 in its length and 0.5 depth of body; head 4.5 in standard length; eye equal to snout, about 3.5 in head, 1.5 in interorbital space; mouth very oblique, its anterior end on level with upper edge of pupil, its posterior angle reaching 0.5 distance from tip of snout to eye; symphyseal hook on lower jaw well developed and fitting into a deep notch on upper jaw.

Squamation: Scales in lateral line 34, in transverse line from middle of back to base of ventral fin 4.5–1–1, in predorsal region 14, around caudal peduncle 16, with 9 rows of scales between the lateral lines counted over the back.

Fins: Dorsal rays ii, 7, longest less than head, origin of fin over middle of a line from posterior margin of eye to terminal tube-bearing scales of lateral line and over fourteenth scale of lateral line; caudal fin longer than head, deeply forked, longest rays 2.5 times the median rays; anal rays iii, 5, longest less than 0.7 of longest dorsal ray; ventral rays i, 7, longest about 1.2 in longest dorsal ray, origin of fin under eleventh scale of lateral line and midway between tip of snout and base of caudal fin; pectoral somewhat longer than head, 1.4 times length of ventral, rays i, 14.

Coloration: A silvery longitudinal band from head to caudal fin overlain posteriorly by a dark stripe which begins as a narrow stripe opposite the dorsal fin and expands on the caudal peduncle; caudal fin bright yellow, with a sharply defined black margin widest on the lobes; other fins hyaline.

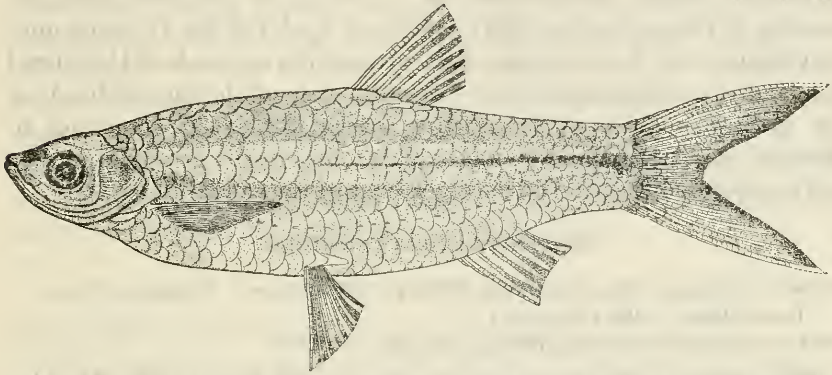


FIGURE 12.—*Rasbora retrodorsalis*, new species: Type (U.S.N.M. No. 119520). Drawn by Mrs. Alice C. Mullen.

Type and paratypes.—The type (U. S. N. M. No. 119520), 14.8 cm. long, was taken March 18, 1924, from a pond in Bangkok connected with a canal and thence with the Menam Chao Phya. Paratypes are U.S.N.M. Nos. 103279, 108119, 108120, and 118444.

Remarks.—This form has been found to be common and widely distributed in Central and Peninsular Thailand. Other specimens are at hand from Bung Borapet, the Menam Chao Phya, and the Menam Tadi near Bandon.

The maximum length of available specimens is 15 cm.

When this fish swims at or near the surface in the turbid waters of ponds, canals, and streams, it would often be practically invisible except for the sharply marked black edge on the caudal fin.

This species is similar to *R. argyrotaenia* but differs therefrom in a number of features. The most noticeable difference is in the position of the dorsal fin which, in *R. argyrotaenia*, arises midway between the tip of the snout and the posterior row of scales on the caudal peduncle, opposite the eleventh scale of the lateral line (Weber and de Beaufort). In the present form the origin of the dorsal fin in the type is midway between the posterior margin of the eye and the last tubule-bearing scale of the lateral line, and in several other specimens is midway between the preopercle and the terminal lateral-line scales; and the fin arises over the fourteenth scale of the lateral line. The tubule-bearing scales in the lateral line number 34 or 35, as against 29 or 30 in typical *R. argyrotaenia.* The circumpeduncular scales are usually 16, sometimes 14, as against 12 in *R. argyrotaenia.*

This form is close to and may prove to be the same as *Rasbora dusonensis* Bleeker from Borneo and Sumatra, synonymized with *R. argyrotaenia* by Günther and by Weber and de Beaufort. Apparent differences between *R. argyrotaenia* and *R. dusonensis* are in the more advanced position of the dorsal fin (its origin in the latter form, according to Bleeker's plate (301) (1863, vol. 3, pl. 120, fig. 1), being midway between the front margin of the eye and the last scale of the lateral line and over the fourteenth or fifteenth scale of the lateral line), in the greater number of lateral-line scales (32 to 36 according to Bleeker's description and 36 in his plate), and in the greater intensity and sharper demarcation of the black edge of the caudal fin.

RASBORA TRILINEATA Steindachner

Rasbora trilineata Steindachner, 1870, p. 637 (Johore; Pengulon Patie).—Hora, 1924a, p. 469 (Tale Sap).
Rasbora stigmatura Fowler, 1934b, p. 341, fig. 5 (Krat).

Hora (1924a) added this species to the known fauna of Thailand by reporting three specimens 25 mm. long taken in the inner lake of Tale Sap. Prior to that time it was ascribed only to Borneo and Sumatra. In 1929 the fish was found at 1,000 feet elevation in a mountain stream on Kao Sabap, and in 1932 it was discovered to be common in Bung Borapet, whence live specimens were taken to Bangkok in October.

A length of 15 cm. is reached by this fish in the Dutch East Indies, but the largest Thailand specimens examined have been under 6 cm.

Color note on living specimens of *R. trilineata* taken in Bung Borapet September 26, 1932: Back pale green, center of scales darker; midside silvery, overlain by a broad diffuse blackish band from head to base of caudal peduncle, with a narrow silvery stripe above it; abdomen, lower side, and under part of head dusky; dusky areas on side of snout and upper half of opercle; a jet-black line on each side above the base of the anal fin, the two lines joining behind the fin and extending to the caudal along the lower edge of peduncle; an incomplete very thin black line before and behind the dorsal; dorsal rays pale greenish yellow, membranes hyaline; basal two-thirds of caudal fin pale yellow, a large subterminal blue-black spot on each lobe, edge of lobe white, median rays black (as from extension of black lateral band); anal, ventral, and pectoral fins hyaline, with a few minute black dots on the membranes.

The species will doubtless prove popular for home aquaria. In a small balanced aquarium in Bangkok the fish lived and thrived for a long time.

Fowler (1934b) described *Rasbora stigmatura* from seven specimens, 3.5 to 5.8 cm. long, taken at Krat in December 1933. The writer happened to see these specimens in Thailand in January 1934, and learned that their source was the Krat River, at Kao Saming. His examination of these specimens, then in the possession of a local collector, indicated that they agreed with specimens he had taken in Bung Borapet. The description of *R. stigmatura* shows no essential difference from *R. trilineata*. Fowler noted the resemblance but thought the former differed from the latter "in the sub-terminal black contrasted blotch on each caudal lobe, besides the other details of its coloration." It may be pointed out, however, that *R. trilineata* is always characterized by a black blotch on each caudal lobe and by other markings shown in Fowler's figure and description. While *R. trilineata* typically has a subterminal black spot on each caudal lobe, in *R. calliura* Boulenger, which Weber and de Beaufort synonymized with *R. trilineata*, the caudal spots are terminal.

RASBORA LAYANGI Fowler

Rasbora layangi FOWLER, 1939, p. 66, fig. 15 (Trang).

A waterfall stream near Trang, in Peninsular Thailand, yielded two specimens, 11.8 and 10.4 cm. long, on which this species is based.

It is very close to *R. trilineata*, being in essential agreement therewith in structural details. Color differences, as indicated in the preceding key, are in the extent and width of the dark longitudinal band, in the absence in *R. layangi* of a black line on each side above the base of the anal fin, and in the possession by the present species of a black posterior edge of the caudal fin, while in *R. trilineata* the black marking is confined to the caudal lobes. The describer notes as a distinguishing color feature the absence of a round black spot on the caudal; this spot, however, is variable, in *R. trilineata*. While it may be present, Weber and de Beaufort do not mention it (unless it is indicated as "a darkish hue" at the caudal base), and some Thailand specimens otherwise typical have no spot whatever.

RASBORA CROMIEI Fowler

Rasbora cromiei FOWLER, 1937, p. 167, fig. 103 (Mepoon, Rayong); 1939, pp. 39, 40, 66 (Khao Bhanam Bencha, Huey Yang, Trang).

The type of this species, 8.9 cm. long, came from Mepoon, Northern Thailand. Numerous other specimens 3.3 to 10.2 cm. long were taken at Mepoon, and a large number were reported also from Rayong, a fishing village on the Gulf of Siam in Southeastern Thailand. A very large series has recently been reported by Fowler from several places in Peninsular Thailand.

Besides the characters shown in the key, the markedly decurved line is separated from the origin of the ventral by 1.5 scales and from the origin of the dorsal by 5 scales, and there is an oblique blackish bar from the upper end of the gill opening to the base of the pectoral.

RASBORA EINTHOVENII (Bleeker)

Leuciscus einthovenii BLEEKER (49), 1851, p. 434 (Sambas, Borneo).

Rasbora einthoveni SAUVAGE, 1881, p. 164 (Siam); 1883b, p. 153 (Menam Chao Phya).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 72 (Siam).

This appears to be a rare species in Thailand, not met with in recent years. It was first reported from Thailand by Sauvage, but a specimen in the Mouhot collection from Pechabun, on the Pasak River, is in the British Museum (listed as *R. daniconius*). Several of the specimens recorded under that name are in the British Museum, having been sent by the Siamese Museum. *R. daniconius* seems to be an Indian species which Weber and de Beaufort differentiate from *R. einthovenii* by characters that included pectoral fins much shorter than the head (longer in *R. einthovenii*) and 9 rows of scales between the lateral lines on the caudal peduncle (7 in *R. einthovenii*).

RASBORA RASBORA (Hamilton)

Cyprinus rasbora HAMILTON, 1822, p. 329, pl. 2, fig. 90 (Bengal).

Rasbora rasbora HORA, 1923b, p. 152 (Bangkok, Nontaburi).

This species, known from Burma and India, was identified by Hora as represented by three adults and one young in a collection from the Menam Chao Phya at Bangkok and Nontaburi. It is known otherwise by five specimens sent to the Siamese Bureau of Fisheries in 1930 from Chantabun by a Boy Scout.

The outstanding characters of the species are the rather broad caudal peduncle, complete lateral line with 26 or 27 scales, a dark longitudinal band extending from the upper angle of the gill opening to the upper half of the caudal base and usually a sharply defined black edge to the caudal fin.

RASBORA LATERISTRIATA LASTERISTRIATA (Bleeker)

FIGURE 13

Leuciscus lateristriatus BLEEKER, 1854 (106), p. 94 (Lakes Meninju, Pajacombo, Telok, Sumatra; Batavia, Tandjongoost, Tjampea, Bandong, Garut, Java).

Rasbora lateristriata MASYA and INDRAMBARYA, 1932, p. 281 (Koh Samui and Koh Pa-ngan).—FOWLER, 1934a, p. 113 (Bangkok, Chiengdao, Chiengmai, Chiengsen, Bua Yai, Chantabun, Nakon Sritamarat); 1934b, p. 339 (Ban Thung Luang); 1935a, p. 110 (Bangkok).

The typical form of this species, abounding on various islands of the East Indian Archipelago, is a common fish in parts of Thailand.

From various upper tributaries of the Nan River, Deignan collected specimens in April and June 1936, all of them approaching the spawning condition. Specimens from Huey Lom, an affluent of the Nan, June 1 to 3, included a female, 5.1 cm. long, with well-developed ovaries, which showed no black spot above the base of the anal fin, while a male, 5.8 cm. long, had the characteristic black spot over the anal. Other specimens obtained by Deignan were from the Meta, a branch of the Meping in the Khun Tan Mountains, in February 1936, the largest a female of 7.3 cm. with nearly ripe eggs, and from a lagoon at Chiengmai in August 1935, of which the largest, 4, 4.5, and 5.4 cm. long, were females with eggs nearly ready for deposition.

Another locality represented in the Deignan collection is the Menam Mao, a branch of the Menam Fang, tributary of the Mekong; 3 specimens, 4.1 to 6 cm. long, were taken December 25, 1936, at a point where the stream was a torrent at the base of mountains.

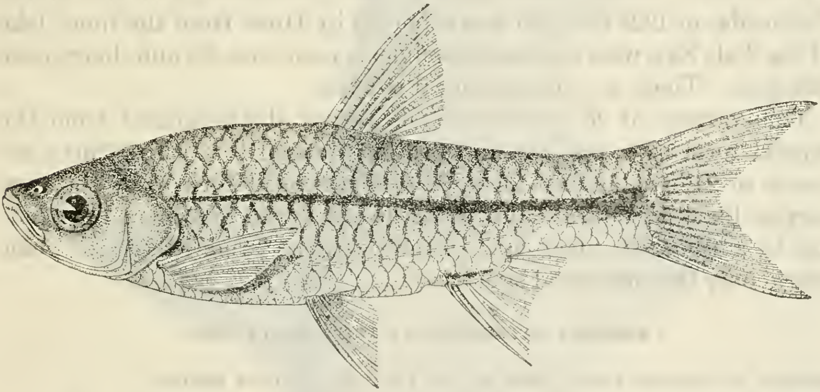


Figure 13.—*Rasbora lateristriata Lateristriata* (Bleeker). Drawn by Luang Masya; courtesy of the Thailand Government.

The maximum length of this species, as given by Weber and de Beaufort, is 12 cm. Fish of this size are quite unusual in Thailand. A batch of 17 specimens taken on Koh Chang in April measured from 3.4 to 8.7 cm. A lot of 19 specimens from Kao Sabap ranged from 3.4 to 11.5; the largest group, taken in April, averaged 8.7 cm. (range 7.2 to 11.5), the smallest group, taken in July, averaged 4.9 cm. (range 3.4 to 5.9).

Although reported as taken in abundance at Bangkok and other lowland places, this species in Thailand is characteristically a fish of cool, clear, swift water such as is met with in mountain streams, and it is well represented on large islands on which it is usually the only species of the genus. The first specimens noted in local waters appear to have been collected by the writer on the curious group of limestone islands in the Tale Sap known as Koh Si Koh Ha, October 7,

1923. It is common in waterfall pools on Koh Chang, and in various waterfall streams on Kao Sabap, near Chantabun. The first published record of the fish for Thailand is that of Luang Masya Chitrakarn and Boon Chuay Indrambarya, of the Siamese Bureau of Fisheries, who collected specimens in swift brooks on Koh Samui and Koh Pa-ngan in May 1931. A further locality from which specimens have been examined is a stream 20 miles west of the railway station of Ban Hoi Toi in Chaiya Province, Peninsular Thailand. It is suggested that the two very young specimens collected on Koh Chang and listed by Hora as *R. argyrotaenia* may have represented this species, which is the only one met with in extensive collecting on that island.

RASBORA LATERISTRIATA SUMATRANA (Bleeker)

Leuciscus sumatranus Bleeker, 1852 (67), p. 601 (Solok, Sumatra).
Rasbora lateristriata sumatrana Hora, 1924a, p. 469 (Tale Sap).

Previously known from Borneo, Nias, Sumatra, and the Malay Peninsula, in 1924 this fish was reported by Hora from the inner lake of the Tale Sap where several specimens, none over 25 mm. long, were collected. There are no other local records.

This variety of *R. lateristriata* is poorly distinguished from the typical form by a few less scales in the lateral line which "may decrease to 24" (as against 26 to 30 in the typical form); by the very narrow blackish lateral band, sometimes reduced to a mere line, ending in a roundish black spot anterior to the caudal base; in older stages only the precaudal spot exists.

RASBORA LATERISTRIATA TRIFASCIATA Popta

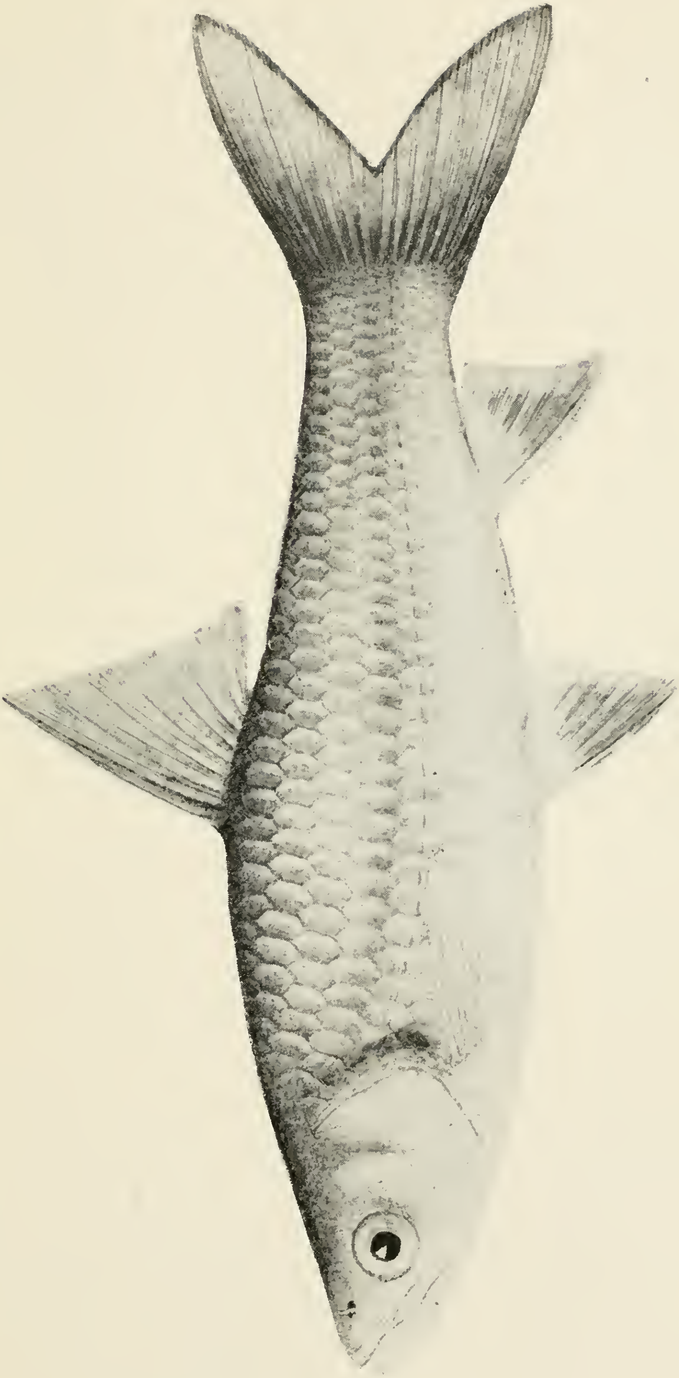
Rasbora trifasciata Popta, 1905, p. 176 (The Bo, Central Borneo).

Examples of *Rasbora lateristriata* from Northern Thailand and other parts of the country resemble the color phase called *R. l. trifasciata*, described from rivers of Borneo, in having on the median lower edge of the caudal peduncle a black stripe, which divides at the anal fin and continues forward on each side of the anal base, becoming wider anteriorly. In some specimens the stripe on the lower caudal peduncle is very faint or altogether absent and the line at the base of the anal may be reduced to an elongate spot anteriorly. This spot corresponds with, but does not closely resemble, the round spot met with in some specimens of typical *R. lateristriata*.

RASBORA CHERONI Fowler

Rasbora cheroni Fowler, 1937, p. 168, fig. 104 (Pitsanulok).

Described from a single specimen, 9.7 cm. long, this species is close to *R. lateristriata* and may be a variant of that very inconstant species.



LEPTOBARBUS HOEVENII (BLEEKER).

Drawn by Luang Masya; courtesy of the Thailand Government.

Subfamily CYPRININAE: Typical Minnows and Carps

The subfamily Cyprininae contains the great bulk of the cyprinoid fishes of Thailand. There are 37 local genera besides the exotic carp *Cyprinus carpio* Linnaeus,[5] and the number of local species is 145. The genera are for the most part well differentiated and may be identified by the following key:

1*a*. Mouth anterior or subinferior.
  2*a*. Lateral line running in lower part of caudal peduncle and terminating below midbase of caudal fin; dorsal fin with 7 or 8 branched rays and no osseous denticulated simple ray.
    3*a*. Ring of suborbital bones of moderate breadth; both lips developed; lower jaw with no sharp bony edge; rostral and maxillary barbels present. Leptobarbus
    3*b*. Ring of suborbital bones broad; no lower lip; lower jaw with a sharp crescentic bony edge; no barbels______________________ Aspidoparia
  2*b*. Lateral line running in middle or lower part of caudal peduncle and terminating at midbase of caudal fin.
    4*a*. Dorsal fin with less than 20 branched rays.
      5*a*. A gelatinous or adipose eyelid; branched dorsal rays 8; last simple dorsal ray osseous and denticulated.
        6*a*. Snout of moderate length, about equal to eye, not abruptly decurved; depth equal to or less than head; minute rostral and maxillary barbels; maxillary extending to vertical from front margin of eye; no postsymphyseal tubercle in lower jaw; gill rakers long; circumpeduncular scales 16; origin of dorsal fin anterior to origin of ventrals; branched anal rays 5______________ Albulichthys
        6*b*. Snout very short and blunt, 0.5 in eye, abruptly decurved; depth greater than head; barbels absent; maxillary extending halfway to vertical from front margin of eye; a small postsymphyseal tubercle on lower jaw; gill rakers rudimentary; circumpeduncular scales 14; origin of dorsal fin posterior to origin of ventrals; branched anal rays 6________________________________ Sikukia
      5*b*. No well-developed annular eyelids.
        7*a*. A procumbent predorsal spine; barbels 4, 2, or none; branched dorsal rays 8 to 10; last simple dorsal ray osseous and entire or denticulated; branched anal rays 6 to 10______________ Mystacoleucus
        7*b*. No procumbent predorsal spine.
          8*a*. Branched dorsal rays 7 to 10.
            9*a*. Scales in lateral line 23 to 60; upper lip present.

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[5] This species, the common carp of Asia, very successfully, perhaps too successfully, transplanted to Europe and thence to America, has escaped from ponds into which it has been introduced from China and is becoming more and more common in the rivers of Central Thailand. It is recorded by Fowler (1937, p. 173) from Bangkok. The fish may be recognized by its terminal mouth, 4 barbels, molarlike pharyngeal teeth in 3 series (3, 1, 1), long dorsal fin (with 17 to 22 branched rays) with its last simple ray ossified and serrated, and short anal fin with its last simple ray strongly ossified and serrated. The common goldfish (*Carassius auratus* Linnaeus), which when escaped from cultivation ultimately reverts to a dark olivaceous color resembling the carp, may be recognized by the absence of barbels, fins essentially as in *Cyprinus carpio*, and pharyngeal teeth in a single series of 4.

10*a*. Lips fringed; scales in lateral line 37 or 38; branched dorsal rays 8; last simple dorsal ray strongly ossified and denticulated; rostral and maxillary barbels________ **Cosmochilus**

10*b*. Lips entire or only upper lip crenulated or fringed.

  11*a*. Mouth large, maxillary extending to or beyond vertical from anterior margin of eye.

    12*a*. Pharyngeal teeth triserial; head of moderate size, 2 to 2.5 in body length; a pair of maxillary barbels; gill rakers short, wide-spaced, about 12 on first arch; branched dorsal rays 8; last simple dorsal ray osseous and finely denticulated; size medium (to 70 cm.). **Hampala**

    12*b*. Pharyngeal teeth uniserial, 4 on each side; head very large, 1.5 or less in body length; no barbels; gill rakers long, close-set, very numerous (95 to 110 on first arch); branched dorsal rays 9; last simple dorsal ray nonosseous and smooth; size very large (to 2 m.)______________________________ **Catlocarpio**

  11*b*. Mouth smaller, maxillary not extending to vertical from anterior margin of eye.

    13*a*. A groove posterior to lower lip.

      14*a*. Lower lip with an uninterrupted posterior groove continuous around corners of mouth.

        15*a*. Lateral line complete; last simple dorsal ray ossified.

          16*a*. Median part of lower lip developed or not as a lobe; 4 barbels; last simple dorsal ray nondenticulated; head with no parallel lines of pores in groups_________________________________ **Tor**

          16*b*. Median part of lower lip not developed as a special lobe; barbels 4, 2, or none; last simple dorsal ray strongly denticulated; head with numerous lines of pores mostly parallel in groups. **Cyclocheilichthys**

        15*b*. Lateral line incomplete, confined to 6 or 7 anterior scales; last simple dorsal ray nonosseous; no barbels; head with numerous lines of pores mostly parallel in groups__________________ **Oreichthys**

      14*b*. Lower lip with posterior groove interrupted in middle.

        17*a*. Pharyngeal teeth uniserial, 4 on each side; only maxillary barbels; last simple dorsal ray osseous and nondenticulated; branched dorsal rays 9; branched anal rays 5; body with dark longitudinal stripes______________________________ **Probarbus**

        17*b*. Pharyngeal teeth biserial; mouth very large; maxillary extending beyond vertical from posterior border of eye; lower jaw with a postsymphyseal knob; third suborbital bone large and entirely behind eye; no barbels; last simple dorsal ray osseous and nondenticulated; scales in lateral line 88 to 94; branched dorsal rays 7 or 8; branched anal rays 10________________________ **Raiamas**

17*c*. Pharyngeal teeth triserial; last simple dorsal ray osseous or nonosseous and denticulated or nondenticulated.

18*a*. Lower lip closely adnate to lower jaw or separated by a superficial sulcus; barbels 4, 2, or none.

19*a*. Body deep, strongly compressed; scales in lateral line 44 to 80 (45 in Siamese species); origin of dorsal fin behind origin of ventrals; branched dorsal rays 8; last simple dorsal ray osseous and denticulated; branched anal rays 11 to 33 (about 30 in Siamese species); barbels rudimentary or absent in local species. **Rohtee**

19*b*. Body mostly moderately elongate and moderately compressed.

20*a*. Lower jaw with a postsymphyseal knob more or less developed; last simple dorsal ray nonosseous and nondenticulated.

21*a*. Mouth large, maxillary reaching to or beyond vertical from eye; lower lip well developed; barbels 4 or none (exceptionally 2); scales in lateral line 31 to 50; origin of dorsal fin posterior to origin of ventrals; branched dorsal rays 7 or 8; branched anal rays 9 to 13_____ **Barilius**

21*b*. Mouth small, maxillary not reaching vertical from anterior border of eye; lower lip very thin or deficient; barbels 4, 2, or none; scales in lateral line 32 to 60; origin of dorsal fin in advance of ventrals; branched dorsal rays 7 to 12; branched anal rays 5________ **Cirrhinus**

20*b*. Lower jaw with no postsymphyseal knob.

22*a*. Snout entire; snout and cheeks without horny tubercles; gill rakers numerous, usually lanceolate; branched dorsal rays 7 to 9; branched anal rays not elongated in male.

23*a*. Last simple anal ray weak or strong, nondenticulated; barbels 4, 2, or none. **Puntius**

23*b*. Last simple anal ray stout, osseous, strongly denticulated; barbels absent. **Puntioplites**

22*b*. Snout with a median and lateral lobes; snout and cheeks beset with horny tubercles; gill rakers few, triangular; branched dorsal rays 8; last anal rays elongated in male, normal in female; barbels rostral and maxillary______________ **Chagunius**

18*b*. Lower lip conspicuously separated from lower jaw, which has a horny sheath; snout and cheeks beset with horny tubercles; barbels rostral and maxillary____________________ **Acrossocheilus**

14*c*. Lower lip with posterior groove forming a pocket that opens backward; upper lip crenulated; no barbels; last simple dorsal ray stout, osseous, strongly denticulated; dorsal, caudal, anal, and ventral fins black-edged---------------------- **Balantiocheilos**

13*b*. No groove posterior to lower lip, which is continuous with skin of throat; no barbels; last simple dorsal ray osseous and denticulated.

24*a*. Body moderately elongate, depth 2.8 to 3.25 in standard length; caudal peduncle longer than deep; snout broad; mouth wide, transverse, and slightly inferior; pharyngeal teeth triserial; gill rakers short spines, about 25 on first arch; scales in lateral line 36 to 40; branched anal rays 5---------- **Scaphiodonichthys**

24*b*. Body short, depth 2 in standard length; caudal peduncle deeper than long; snout contracted; mouth small, terminal; lower lip confined to sides of jaw, median part of jaw a slender, sharp-edged bony scoop; pharyngeal teeth biserial; gill rakers slender, widespaced, 12 on first arch; scales in lateral line 28 or 29; branched dorsal rays 14; branched anal rays 6. **Scaphognathops**

9*b*. Scales in lateral line 58 to 65; upper lip, barbels, and gill rakers absent; branched dorsal rays 8 to 10; last simple dorsal ray nonosseous and nondenticulated-------------- **Thynnichthys**

8*b*. Branched dorsal rays 11 to 18.

25*a*. Pharyngeal teeth triserial; last simple dorsal ray nonosseous and nondenticulated; barbels rostral and usually maxillary; branched anal rays 5------------------------- **Osteochilus**

25*b*. Pharyngeal teeth uniserial, 5 on each side; last simple dorsal ray osseous and nondenticulated; barbels maxillary or none; branched anal rays 11 to 14--------------- **Acanthorhodeus**

4*b*. Dorsal fin with 21 to 30 branched rays; last simple dorsal ray nonosseous and nondenticulated; snout usually with pores which may bear horny tubercles; rostral and maxillary barbels; lips fringed; lower lip separated by a sulcus from lower jaw, which has a sharp edge. **Labiobarbus**

1*b*. Mouth conspicuously inferior.

26*a*. A well-marked annular eyelid; last simple dorsal ray osseous and denticulated; branched dorsal rays 8 or 9.

27*a*. Snout obliquely truncate, with a small median lobe; mouth below lower level of eyes; nostrils nearer to tip of snout than to eyes; lips continuous---------------------------------- **Amblyrhynchichthys**

27*b*. Snout evenly rounded, with a large median lobe; mouth above lower level of eyes; nostrils nearer to eyes than to tip of snout; lips joined by a frenulum---------------------------------- **Xenocheilichthys**

26*b*. Annular eyelid, if present, not well marked; branched dorsal rays 8 to 18.

28*a*. Last simple dorsal ray osseous and denticulated; branched dorsal rays 8; lips fully papillate--------------------------------- **Papillocheilus**

28*b*. Last simple dorsal ray nonosseous and nondenticulated; lips not papillate.

29*a*. Suborbital bones enlarged, covering most of cheek; a small postsymphyseal tubercle on lower jaw, mouth wide, with longitudinal folds on palate; lower lip laterally papillate; branched dorsal rays 8 ---------- Barbichthys

29*b*. Suborbital bones not enlarged; no postsymphyseal tubercle on lower jaw.

  30*a*. Lower lip consisting of a deep part continuous with upper lip and a superficial part continuous with skin of isthmus; branched dorsal rays 8 or 9.

    31*a*. Superficial part of lower lip thin and covering deep part medianly.

      32*a*. Lateral line present; upper lip entire, barbels rostral and maxillary or only maxillary in Siamese species (absent in one local species) ---------- Tylognathus

      32*b*. Lateral line absent; upper lip plicate; barbels rostral. Holotylognathus

    31*b*. Superficial part of lower lip consisting of a thick fleshy pad which completely covers the deeper part both medianly and laterally; barbels rostral and maxillary, only maxillary in some Siamese species ---------- Lobocheilus

  30*b*. Lower lip entirely separated from isthmus by a deep groove; snout with a lateral lobe; lips fringed; barbels rostral and maxillary; branched dorsal rays 15 to 18 ---------- Morulius

  30*c*. Lower lip joined to isthmus by a bridge; snout with or without a lateral lobe; lips fringed, lobate, or entire; barbels rostral or maxillary or both.

    33*a*. Rostral fold not crenulated and not medianly incised; one or both lips with a transverse inner fold; branched dorsal rays 10 to 15. Labeo

    33*b*. Rostral fold crenulated and medianly incised; no transverse inner labial fold; branched dorsal rays 8 ---------- Henicorhynchus

Genus LEPTOBARBUS Bleeker

Leptobarbus BLEEKER (261), Nat. Tijdschr. Nederl.-Indië, vol. 20, p. 435, 1859–60. (Type, *Barbus hoevenii* Bleeker.)

Fishes of this genus, inhabiting fresh waters of Borneo, Sumatra, and Thailand, may be recognized by their broad head, four well-developed barbels (rostral and maxillary), moderate-sized mouth with maxillary reaching vertical from front of eye, spoon-shaped pharyngeal teeth in three rows (5, 3, 2), medium-sized scales, continuous lateral line running in lower part of caudal peduncle, and short dorsal and anal fins with seven and five branched rays respectively. Of the two species ascribed to Thailand (keyed below), one is common and the other is of somewhat doubtful status.

1*a*. Scales in transverse series from midline of back to midline of abdomen 4.5–1–3.5; a black longitudinal band on body in young, disappearing in adult ---------- hoevenii

1*b*. Scales in transverse series from midline of back to midline of abdomen 5.5–1–4.5; a black longitudinal band on body at all ages ---------- melanotaenia

LEPTOBARBUS HOEVENII (Bleeker)

PLATE 3

Barbus hoevenii BLEEKER, 1851 (45), p. 207 (Bandjermassing, Borneo).

Leptobarbus hoevenii BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).—SAUVAGE, 1881, p. 164 (Siam); 1883b, p. 152 (Menam Chao Phya).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 96 (Siam).—HORA, 1923b, p. 153 (Bangkok).—VIPULYA, 1923, p. 226 (Bangkok).—FOWLER, 1935a, p. 112 (Bangkok); 1937, p. 174 (Bangkok).

Barbus (Leptobarbus) hoevenii PETERS, 1868, p. 272 (Siam).

This river fish of Sumatra and Borneo is common throughout the length of the Menam Chao Phya and is known also from Bung Borapet and the Menam Nan, as well as from various streams connecting with the Menam Chao Phya in the great central plain of Thailand. The fish has been taken in the Menam Mun east of Korat and is thus an inhabitant of the Mekong basin.

A length of half a meter is attained, and at all sizes the fish is beautiful. In small and medium-sized examples there is a sharply defined broad black lateral band from head to base of caudal fin. This band, intensified in the young, becomes obscure or altogether disappears in the larger fish. A male specimen 30 cm. long taken from the Menam Chao Phya above Bangkok on September 1, 1923, had in life the following coloration: Scales of back and sides light green with dark green centers; belly white; top of head rich grass green with rosy reflections; opercles lustrous golden or brassy yellow; a black blotch behind opercle; iris yellow; dorsal fin hyaline green, ventrals and anal blood red, caudal red distally and dull green at base with the intervening part light gray, and pectorals hyaline.

This fish is often caught by anglers using as bait prawns, paste, pieces of various succulent leaves, etc. When hooked it puts up a rather good fight.

Among the Thai this fish is known as *pla ba* or *pla ai ba* (*ba*, mad), in allusion to its peculiar behavior at times. When large fruit capsules of the chaulmoogra-tree (*Hydnocarpus*) fall into the streams, either directly from the trees or by being washed in from the banks by rains, the fish gorges itself on the parenchyma and seeds and is reported to become intoxicated and to behave in a peculiar manner. Its flesh then is said to be poisonous to human beings. As a food fish, however, its reputation is not high at any time.

LEPTOBARBUS MELANOTAENIA Boulenger

Leptobarbus melanotaenia BOULENGER, 1894a, p. 249 (Bongon, N. Borneo).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 97 (Siam).

This species, otherwise known only from Borneo, is listed by Weber and de Beaufort as occurring in Thailand on the strength of a specimen from that country said to be in the British Museum. There seems to be some error, however, as J. R. Norman, of the British Museum (in a letter to the writer dated October 2, 1933), stated that there is no specimen of *L. melanotaenia* from Thailand in the British Museum, which has only the types, although there is an example of *L. hoevenii* from Bangkok.

These two forms are very similar, differing almost entirely in the number of scales in transverse series. The black lateral band, which seems to characterize *L. melanotaenia* at all ages, is present in *L. hoevenii* up to a length of 15 to 17 cm. or sometimes longer.

Genus ASPIDOPARIA Heckel

Aspidoparia Heckel, *in* Fenzl, Abbild. Thiere Pfl. Syr., Fische, p. 186, 1843. (Type, *Aspidoparia sardina* Heckel.)

The fishes of this genus may be readily recognized by the peculiar mouth (absence of lower lip, lower jaw with a sharp, crescentic bony edge), absence of barbels, broad ring of suborbital bones, greatly decurved lateral line running in the lower half of the caudal peduncle, dorsal fin arising well behind the ventrals and having no osseous rays and 7 or 8 branched rays, anal fin with 9 to 12 rays of which 7 to 10 are branched, and pharyngeal teeth plow-shaped and in 2 or 3 rows.

The first references to these fishes in scientific literature appear to have been by Hamilton (1822), who placed one of the two Indian species in the composite genus *Chela* and called it *morar*, and the other in the composite genus *Cabdio* and called it *jaya*. Bleeker (1863 [314]) made *morar* the type of his genus *Morara* (1859) and at the same time recognized *Aspidoparia* of Heckel (1843) and indicated *A. sardina* as the type, unaware that *Morara* was a synonym of *Aspidoparia* and *sardina* a synonym of *morar*. To add to the confusion, Jordan (1917, pt. 1, 115) apparently intended to validate *Cabdio* and designated *jaya*, "the first species named," as the type, although it had long been known that *jaya* is an *Aspidoparia*. Jordan's action may, however, have served the useful purpose of making *Cabdio* unavailable for any of the other mixed lot that Hamilton included under this name.

In addition to the single species known from Thailand, another has been ascribed to that country and is here considered, although it is quite obviously not entitled to a place in this genus, and its exact status remains to be determined.

ASPIDOPARIA MORAR (Hamilton)

Cyprinus morar Hamilton, 1822, p. 264, pl. 31, fig. 75 (Yamuna and Tista Rivers).

This common species of Burma and India, not previously reported from Thailand, was to be expected in parts of Thailand contiguous to Burma. A specimen 7.8 cm. long was taken by Deignan in the Salwin at Ta Ta Fang, October 14, 1936. It agrees with Day's description, having 38 scales in the lateral line and 5 scales above and 5 below the lateral line to the base of the ventral, with dorsal rays ii, 7 and anal rays ii, 9.

A length of 17 to 18 cm. is attained in India.

ASPIDOPARIA SIAMENSIS (Sauvage)

Morara siamensis Bleeker, 1865 (347), p. 35 (nomen nudum) (Siam); 1865 (356), p. 175 (nomen nudum) (Siam).—Sauvage, 1881, pp. 164, 187 (Bangkok).

In 1865 Bleeker (347) gave a list of fishes examined by him in the Musée du Jardin des Plantes à Paris, collected in the Menam Chao Phya by Bocourt, and mentioned "*Morara siamensis* Blkr, nov. spec." but without description, including it with a number of species "restent à décrire." Later in the same year (356), Bleeker listed without description "*Morara siamensis* Blkr."

It was not until 1881 that Sauvage gave a description of *Morara siamensis*, based on a specimen, 11 cm. long, from Bangkok in the Paris Museum. Sauvage improperly credited the species to Bleeker.

An examination of Sauvage's description at once suggests an error in the allocation of this fish to the genus *Morara* or *Aspidoparia*, as shown by the references to the position of the lateral line, to the origin of the dorsal fin, and to the number of anal rays.

In January 1939, at the request of the U. S. National Museum, Dr. Jacques Pellegrin, of the Muséum National d'Histoire Naturelle in Paris, courteously examined the specimens in that museum on which *Morara siamensis* had been based and communicated the results of his examination. The specimens, 4 in number, collected at Bangkok in 1862 by F. Bocourt, are 118, 90, 90, and 85 mm. long. The scales in the lateral line are 33 to 35, in the transverse series 5.5-1-5.5, with 4 scales between the lateral line and the base of the ventral fin, the predorsal scales number 11 and the circumpenduncular scales 16; the lateral line runs in the middle of the caudal peduncle; dorsal rays iii,8, anal rays iii,5, ventral fins arising under the second or third branched ray of the dorsal. Dr. Pellegrin wrote that this species is "far removed from *Morara morar* and without doubt of a different genus," a conclusion fully justified by the origin of the dorsal fin in advance of the ventrals, by the number of branched anal rays, and by the position of the lateral line on the caudal peduncle, all of which features conflict with the generic definition.

The present reviewer is unable with any degree of certainty to determine the generic position of this fish or to state whether it is specifically valid.

Genus ALBULICHTHYS Bleeker

Albulichthys Bleeker (261), Nat. Tijdschr. Nederl.-Indië, vol. 20, p. 430, 1860. (Type, *Systomus albuloides* Bleeker.)

ALBULICHTHYS ALBULOIDES (Bleeker)

Systomus albuloides BLEEKER, 1855 (139), p. 425 (Kapuas River, Pontianak, Bandjermassing, Borneo).

Albulichthys albuloides SMITH, 1931d, p. 186 (Menam Chao Phya, Menam Nakon Nayok); 1931f, p. 138 (Siam); 1931f, p. 138.—FOWLER, 1935a, p. 112 (Bangkok); 1937, p. 174 (Bangkok).

Previously recorded only from Borneo and Sumatra, this species was added to the known fauna of Thailand in August 1923, when five small specimens were collected by the writer in the Menam Chao Phya at Paknam. Since then the fish has been met with in various parts of that river below Ayuthia and also in the Nakon Nayok.

In the East Indies the fish attains a length of 36 cm. In Thailand the largest example preserved was 28 cm. long. A specimen, 22.5 cm. long, taken in the Nakon Nayok on June 6, 1928, was a female with large ovaries.

An example, 28 cm. long, from the Menam Chao Phya at Koh Yai, March 23, 1928, was lustrous silvery, with the dorsal fin pale yellowish except for a black line from the middle of the first simple ray to the tip of the serrated spine and a dusky posterior edge, and the caudal fin orange, with a broad black posterior margin.

Elsewhere (Smith, 1931d, 1931e) the writer has drawn attention to the fact that all local specimens of *Albulichthys albuloides* have small but distinct rostral and maxillary barbels, although Bleeker, who described the genus, and Weber and de Beaufort, who have brought Bleeker's work up to date, state that there are no barbels. Whether barbels are actually lacking in fish from Borneo and Sumatra or have been overlooked remains to be determined. In any event, a modification of the definition of the genus *Albulichthys* is necessary.

The only vernacular name recorded for this fish is *pla takok*, shared with various species of *Cyclocheilichthys* from which it is apparently not always distinguished by fishermen.

Genus SIKUKIA H. M. Smith

Sikukia H. M. SMITH, Copeia, 1931, No. 3, p. 138. (Type, *Sikukia stejnegeri* H. M. Smith.)

The genus *Sikukia*, established for *S. stejnegeri*, resembles the genera *Amblyrhynchichthys*, *Xenocheilichthys*, and *Albulichthys*. Resemblance to *Amblyrhynchichthys*, its closest relative, is in the short, blunt snout; large eye with adipose eyelid; absence of barbels; and denticulated simple dorsal ray. Differences are in the mouth (small and terminal in *Sikukia*, larger and inferior in *Amblyrhynchichthys*), rostral fold (triangular, partly covering the upper lip, and in reality so distinctly separated from the rest of the snout as to constitute a median lobe in *Amblyrhynchichthys*, entire and covering the upper lip in *Sikukia*), and nostrils (at front of snout and partly inferior in *Amblyrhynchichthys*, high on snout and superior in *Sikukia*).

SIKUKIA STEJNEGERI H. M. Smith

Sikukia stejnegeri Smith, 1931e, p. 138 (Sikuk River).

The type specimen of this species, 11 cm. long, taken in the Sikuk River, Central Thailand, November 26, 1923, remains unique, except for a specimen, 6.9 cm. long, from the Pasak River, Central Thailand, August 20, 1923.

Genus MYSTACOLEUCUS Günther

Mystacoleucus Günther, Catalogue of the fishes in the British Museum, vol. 7, p. 206, 1868. (Type, *Sysiomus* (*Capoeta*) *padangensis* Bleeker.)

Although Günther established this very distinct genus, he failed to mention or recognize its most outstanding character, namely, the presence of a procumbent predorsal spine; and he listed in the complex genus *Barbus*, under the name *Barbus obtusirostris*, a species (*marginatus*) that properly belongs in *Mystacoleucus*.

The essential features and limitations of this genus are: Body moderately elongate, more or less strongly compressed; abdomen rounded; head small; eye comparatively large, pupil or entire eye in advance of midlength of head; snout poriferous, overhanging small, strongly arched subterminal or slightly inferior mouth; lips thin, continuous around corners of mouth, upper lip separated from skin of snout by a deep groove, lower lip closely adnate to jaw, a postlabial groove on each side; barbels four (rostral and maxillary), two (maxillary), or none; pharyngeal teeth 4, 3, 2, uncinate; gill membranes narrowly joined to isthmus at or slightly behind vertical from posterior border of eye; gill rakers few, short, wide-spaced, spinous or conical; scales of moderate size, extending on nape approximately over anterior border of opercle; lateral line complete, extending along middle of caudal peduncle; a procumbent predorsal spine which may perforate first, second, or third predorsal scale, or may be concealed by scales; dorsal fin arising about opposite base of ventrals, its last simple ray osseous and denticulated or non-osseous and simple, branched rays eight or nine; branched anal rays six to ten.

Because of important nomenclatural and taxonomic questions involved, it seems desirable to refer in this place to a paper by Dr. Hora (1937f) in which, in a discussion of cyprinoid fishes with a procumbent predorsal spine, he placed the well-known Indian fish *Rohtee ogilbii* Sykes (1839) in the genus *Mystacoleucus* for the reason that he found in a number of specimens in the Indian Museum a procumbent predorsal spine, which in some of them was obvious, in others was concealed by scales. Of the half dozen species of *Rohtee*, only *ogilbii* was involved in this reallocation. In a subsequent paper Hora (1939,

p. 402) reaffirmed the assignment of *R. ogilbii* to *Mystacoleucus.* This matter may be briefly considered from the nomenclatural and the morphological viewpoints.

The genus *Rohtee* was established by Sykes in 1939, with three new Indian species included, *ogilbii*, *vigorsi*, and *pangut.* No species was singled out as the type by any indication, designation, or implication; but nevertheless Jordan (1919, pt. 2, p. 210) stated, apparently without warrant, that *R. vigorsi* is the orthotype, which term is defined as "the type of a genus as indicated or distinctly implied by the original author." The first designation of a type in *Rohtee* was by Bleeker (1863 [314]) when "*R. ogilbyi*" was definitely selected.

It is evident therefore that if the species *Rohtee ogilbii* really belongs in the genus *Mystacoleucus*, as claimed by Hora, then *Rohtee* is the proper generic name for the various species now called *Mystacoleucus*, the latter being a synonym. It also follows that the various species, other than *ogilbii*, now known as *Rohtee* must take another generic name.

These changes in nomenclature, however, would be very unfortunate and are believed to be unnecessary. While *R. ogilbii* has a procumbent predorsal spine, the writer holds the opinion (1) that this feature alone does not justify the separation of the species from its congeners with which it is otherwise in complete agreement and (2) that the general facies, the backward origin of the dorsal fin with reference to the ventral fins, the more numerous scales (55 in lateral line in *R. ogilbii* as against a maximum of 39 in any species of *Mystacoleucus*), the longer anal fin (with 13 or 14 branched rays as against 6 to 10 in *Mystacoleucus*), and similar features should be given greater weight collectively than the procumbent spine.

Of the four local species of *Mystacoleucus*, two have been known for a long time and two have recently been described as peculiar to Thailand. They may be differentiated as follows:

1*a*. Branched anal rays 6; last simple dorsal ray osseous and denticulated; barbels 4; scales in lateral line 33 to 35; predorsal scales 12 or 13; circumpeduncular scales 16; dorsal fin yellow to red, with a sharply defined black edge; caudal fin with no black edge------------------ argenteus

1*b*. Branched anal rays 7 to 10.

  2*a*. Last simple dorsal ray nonosseous and nondenticulated; no barbels; scales in lateral line 31 or 32; predorsal scales 8 or 9; a large black spot occupying apex of dorsal fin; free margin of dorsal and caudal fins not sharply edged with black------------------------------ atridorsalis

  2*b*. Last simple dorsal ray osseous and denticulated; 4 barbels; scales in lateral line 24 to 29; free margin of dorsal and caudal fins with sharply defined black edge; front edge of dorsal fin black.

    3*a*. Predorsal scales 6 to 8; some scales of back and side with a dark basal crescent--- chilopterus

    3*b*. Predorsal scales 9 or 10; each scale of back and side with a black basal crescent --- marginatus

MYSTACOLEUCUS ARGENTEUS (Day)

Acanthonotus argenteus Day, 1888, p. 807 (Tenasserim). (After Tickell's MS.)
Matsya argentea Day, 1889, p. 293, fig. 102 (Tenasserim). (New generic name.)
Mystacoleucus argenteus Smith, 1933a, p. 79 (Salwin and tributaries in Siam and Burma).—Hora, 1939, p. 401, fig. (Burma).

Under the manuscript name *Acanthonotus argenteus* of Tickell, Day (1888) published a description of a small cyprinoid fish (largest 5.4 inches) said by Tickell to be "very common in the streams of the interior of the Tenasserim district" of Burma. As the generic name *Acanthonotus* had been thrice preoccupied in ichthyology, Day later established the genus *Matsya* for the accommodation of the fish that for many years was known as *Matsya argentea.* The genus *Matsya* was inadequately characterized, the chief distinctive feature being a small forwardly directed spine anterior to the dorsal fin; but from the description and figure of the species it appears that the dorsal fin had 8 branched rays preceded by a single strong serrated spine, the anal fin had 7 simple and branched rays, there were 30 scales in the lateral line, no barbels were referred to in the text or shown in the figure (although barbels were subsequently shown to be present), and the brilliant silvery of the body and head was relieved by lilac and blue shades and a tinge of olive-yellow on the back, with the dorsal fin orange-scarlet, its edge bordered with black except on the last two rays, the other fins lemon-yellow.

A series of nine specimens in the U. S. National Museum were collected by Deignan at Ta Ta Fang in October 1936. These are 6.9 to 8.2 cm. long. The tube-bearing scales in the lateral line are 33 to 35, the scales in the transverse line from the midline of the back to the base of the ventral fins are 7.5–1–3 or 3.5, the predorsal scales are 12 or 13, and the circumpeduncular scales are 16; the dorsal rays are ii,8 or iii,8, with the last simple ray osseous and strongly denticulated, and the anal rays are ii,6; the rostral barbels are somewhat shorter than the maxillary and both are shorter than the eye; the sharply defined jet-black margin of the dorsal fin becomes very narrow or may be practically deficient at the last two rays. A specimen from Huey Mekong Kha, a brook tributary to the Salwin west of Mesarieng, Western Thailand, is 10.5 cm. long and is a female with well-ripened eggs.

Day does not appear to have seen the fish, the Indian Museum and the British Museum had no specimens, and the species remained something of an ichthyological mystery until many specimens collected by H. G. Deignan and the writer in the Salwin and its tributaries in Thailand and Burma in 1932, 1933, and 1936 proved to be Day's species.

In 1931 (Smith, 1931d, p. 185), from an examination of Day's description and figure, the writer expressed the opinion that "no characters are ascribed to *Matsya* by Day that are not possessed by *Mystacoleucus*, and it is altogether probable that the two are identical." The principal difficulty in recognizing *Matsya* as a synonym of *Mystacoleucus* arose from the assumption by Indian ichthyologists that *Matsya argentea* possessed only 5 branched rays in the anal fin, an assumption that Day's figure did not seem to justify, and which was later shown to be incorrect.

Under the caption *Mystacoleucus argenteus*, the writer (1933a) published a note on numerous specimens that he obtained in December 1932, and January and February 1933, in the Salwin at Ta Ta Fang, Thailand, and in five branches of the Salwin in Thailand and Burma; following the original defect in the description and figure, these specimens were incorrectly referred to as having no barbels, whereas they show two well-developed pairs of barbels.

The most recent contribution to the taxonomy of this species is a detailed paper by Dr. Hora (1939), in which he reconsiders his former (1937e) view that *Matsya* is a genus distinct from *Mystacoleucus.* In view of his statement (1939, p. 402) that "besides Day and the writer, Vinciguerra is the only ichthyologist who has commented on the systematic position of *Matsya argentea*," it may be assumed that Dr. Hora overlooked the preceding citations, which were supplemented by a number of letters indicating that *Matsya* is not a tenable genus.

MYSTACOLEUCUS ATRIDORSALIS Fowler

Mystacoleucus atridorsalis Fowler, 1937, p. 176, figs. 112, 113 (Kemarat).

This species is known from two specimens, 6.6 and 6.7 cm. long, from the Mekong at Kemarat, Eastern Thailand. It has no barbels and is distinguishable by a large jet-black area on the distal part of the dorsal fin.

MYSTACOLEUCUS CHILOPTERUS Fowler

Mystacoleucus chilopterus Fowler, 1935a, p. 112, fig. 46 (Srisawat); 1937, p. 176 (Mepoon).

Originally described from three specimens, 9.5 to 10.4 cm. long, from Srisawat, Central Thailand, this fish was later noted by Fowler from Mepoon, Central Thailand. Two specimens, 12 cm. long, from the Mekok at Chiengrai were taken by the writer on March 2, 1924.

The species is very close to *M. marginatus*, differing apparently in fewer predorsal scales and body coloration. The free margins of the dorsal and caudal fins have a sharply defined narrow black edge, as in *M. marginatus*, and each caudal lobe has a dark submarginal longitudinal streak.

MYSTACOLEUCUS MARGINATUS (Cuvier and Valenciennes)

Barbus marginatus Cuvier and Valenciennes, 1842, vol. 16, p. 164 (Tjicanigui River and Sijira, Java).

Mystacoleucus marginatus Smith, 1931d, p. 185 (Siam generally).— Fowler, 1934a, p. 115 (Chiengmai); 1934b, p. 342 (Ban Thung Luang); 1935a, p. 114 (Srisawat, Khao Nam Poo); 1937, p. 176 (Mepoon, Kemarat); 1939, pp. 41, 68 (Huey Yang, Trang).

This species, known from Java, Borneo, Sumatra, and Malaya, has a wide distribution in Thailand. In the basin of the Menam Chao Phya, no specimens appear to have been obtained south of Paknampo. It has been found in the upper part of the Menam Nan; in the Mewang at Lampang and in the Mesoi, a tributary of the Mewang; and in the Meping and a number of its tributaries, including the Mekham. In the Meklong the species is known from both branches, the Kwe Yai at Kanburi and the Kwe Noi at Saiyok. In Peninsular Thailand, the fish has been ascertained to inhabit the Tapi River near Bandon; various streams at or near the towns of Nakon Sritamarat and Ronpibun; a small hill stream near Patalung; and the Patina River, a specimen from the last, collected by Annandale and Robinson, being in the British Museum (listed as *Barbus obtusirostris*).

The fish was first found to be an inhabitant of the Mekong Basin by the taking of specimens in the Mekok at Chiengrai in March 1924. On February 16, 1929, a specimen was collected at Pong, on the Nam Pong, a branch of the Nam Chi, which, in turn, flows into the Menam Mun, the principal tributary of the Mekong in Thailand. At Pakjong, on headwaters of the Menam Mun, a specimen obtained on June 21, 1934, was typical except for the absence of rostral barbels. More recently Fowler reported it from the Mekong itself at Kemarat, Eastern Thailand, and from the Peninsular region in Huey Yang and in the Trang waterfall stream.

The largest example met with in local waters was 20 cm. long, taken in Klong Tadi, Nakon Sritamarat. Full maturity is attained at half that size. Examples over 17 cm. long are uncommon.

The development of the barbels varies with size, sex, and other conditions. The maxillary barbels are usually about twice the length of the rostral, and may equal the diameter of the eye or be only one-third that size. Of two specimens from the headwaters of the Menam Nan at Muang Ngop, April 23, 1936, one, a male 10.5 cm. long, had maxillary barbels one-third the diameter of the eye; the other, a female 14.2 cm. long with well-developed ova, had maxillary barbels two-thirds the diameter of the eye. In five specimens 6.3 to 7.6 cm. long from the Menam Nan, March 31, 1936, these barbels are half the diameter of the eye, while in various specimens 9.3 to 12 cm. long from the Mekok in July and August the maxillary barbels equal the diameter of the eye.

The usual shape of the anal fin is truncate, as stated by Weber and de Beaufort (1916, vol. 3). There is, however, considerable variation. Thus, a female, 14.2 cm. long, from the Menam Nan, has the free margin of the anal fin strongly convex, while a male 10.5 cm. taken at the same place and time has a markedly emarginate anal.

The occurrence of this species in lower Burma (Tenasserim) was reported by Mukerji (1932, p. 285). The single specimen available, 7.5 cm. long, from the Kyenchaung River in the Mergui district, was figured and was said to "agree in all essential details" with the description of *Mystacoleucus marginatus* given by Weber and de Beaufort; but the figure shows only 7 branched rays in the dorsal fin and 7 branched anal rays, numbers that are excluded from the definition of the genus as stated by Weber and de Beaufort. Mukerji compared the Burmese fish with a specimen of *M. marginatus* collected by the writer in Peninsular Thailand, and noted that whereas in the former specimen the procumbent predorsal spine perforates the first predorsal scale, in the Thailand example the spine perforates the third predorsal scale. The identity of the Burmese fish must be regarded as unsettled. Inasmuch as *M. marginatus* is otherwise unknown from Burma, and the place of capture of this particular specimen is included within "the interior of Tenasserim" where Tickell reported *Acanthonotus argenteus* as very common, the possibility that Mukerji's specimen represents *M. argenteus* is to be considered, and a reexamination and full description are desirable.

Vernacular names borne by this species in different parts of Thailand are distinctive. Throughout the Peninsula the fish is called *pla ya*. In the valley of the Nan River the name *pla nam bi* is in general use. Along the Meping and its branches the usual vernacular designation is *pla kiyok*, which is heard also on the Mekok at Chiengrai.

Genus COSMOCHILUS Sauvage

Cosmochilus Sauvage Bull. Soc. Philom. Paris, ser. 7, vol. 2, p. 240, 1878. (Type, *Cosmochilus harmandi* Sauvage.)

COSMOCHILUS HARMANDI Sauvage

Cosmochilus harmandi Sauvage, 1878b, p. 240 (Laos, Indo-China).—Hora, 1923b, p. 158 (Bangkok).—Fowler, 1935a, p. 120, figs. 58, 59 (Bangkok); 1937, p. 183, figs. 149, 150 (Bangkok).

Described from Indo-China in 1878, this species has been found to be not rare in the lower courses of the Menam Chao Phya and some of the connecting streams. It is commonest in the stretch of river between Ayuthia and Bangkok, and many examples therefrom caught with cast net, seine, or pongpang have been preserved. At Pakret on December 24, 1924, the use of cast nets indicated that this was one of the commonest species, and six specimens were preserved for the Siamese Bureau of Fisheries; in life the back had a rich, pale blue color, and the dorsal and caudal fins were black-edged. In some specimens there is a black tip to the anal fin. The type specimen was 37 cm. long.

The largest local examples have been 19 cm. long, with many 10 to 14 cm.

In the Thai vernacular the fish shares with *Cyclocheilichthys* the names *pla nam lang* and *pla takok;* a local name used at Bang Sai is *pla takok dok chok.*

Genus HAMPALA van Hasselt

Hampala VAN HASSELT, Alg. Konst. Letterbode, vol. 2, No. 35, p. 132, 1823. (Type, *Hampala macrolepidota* VAN HASSELT.)

One may follow Bleeker in crediting this generic name to van Hasselt, rather than to Bleeker, as has been done by Weber and de Beaufort. Of the two local forms, keyed below, one has a wide Oriental distribution, the other is restricted to Eastern Thailand and Cambodia.

1*a*. Adult with body marked by a blackish cross band or blotch between anterior dorsal rays and ventral fin; each caudal lobe with a sharply defined black marginal longitudinal band; maxillary barbel about equal to or longer than eye; caudal lobes of equal length........................ macrolepidota

1*b*. Adult with body marked by a roundish blackish spot above lateral line between dorsal and ventral fins; no sharply defined black marginal band on caudal lobes, which are distally diffused blackish; maxillary barbels less than half eye; caudal lobes unequal, the lower longer........................ dispar

HAMPALA MACROLEPIDOTA van Hasselt

FIGURE 14

Hampala macrolepidota VAN HASSELT, 1823, p. 132 (Buitenzorg, Java).—BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).—SAUVAGE, 1881, pp. 163, 186 (Siam); 1883b, p. 152 (Menam Chao Phya).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 143, fig. 60 (Siam).—HORA, 1923b, p. 154 (Bangkok).—VIPULYA, 1923, p. 226 (Bangkok).—HORA, 1924a, p. 470 (Tale Sap).—FOWLER, 1934a, p. 119 (Bangkok, Chiengmai, Chiengsen, Bua Yai); 1935a, p. 120 (Keng Sok); 1937, p. 184, figs. 128–139 (Bangkok, Tachin, Mepoon, Kemarat); 1939, pp. 39, 70 (Khao Bhanam Bencha, Trang).

Barbus (*Hampala*) *hampal* VON MARTENS, 1876, p. 402 (Bangkok).

The range of this species includes Java, Sumatra, Borneo, Malaya, Burma, French Indo-China, and Thailand. In Thailand it is found throughout the length and breadth of the country in streams and lakes. In some places and during certain seasons it may be very abundant and constitute an important part of the commercial catch. Specimens have been examined from the Patani River and Tale Sap in the Peninsula; from numerous places in the central plain, including Bung Borapet; from the Meping in the Northern area; from the

Mekong and Menam Mun in the Eastern region; and from various streams in the Chantabun-Krat district of Southeastern Thailand.

Under the influence of freshets in coastal rivers, this species may go into the Gulf of Siam. Thus, on October 30, 1923, in a trap well off the mouth of the Tachin River, a number of examples of this fish were taken, and two, 12.6 and 13.6 cm. long, were preserved.

Examples in excess of 50 cm. long have been met with in Thailand, but with the increase in fishing activity such large fish are becoming scarcer. The usual size of adult specimens in recent years has been 20 to 30 cm. A length of 70 cm. is reported for the Indo-Australian Archipelago by Weber and de Beaufort.

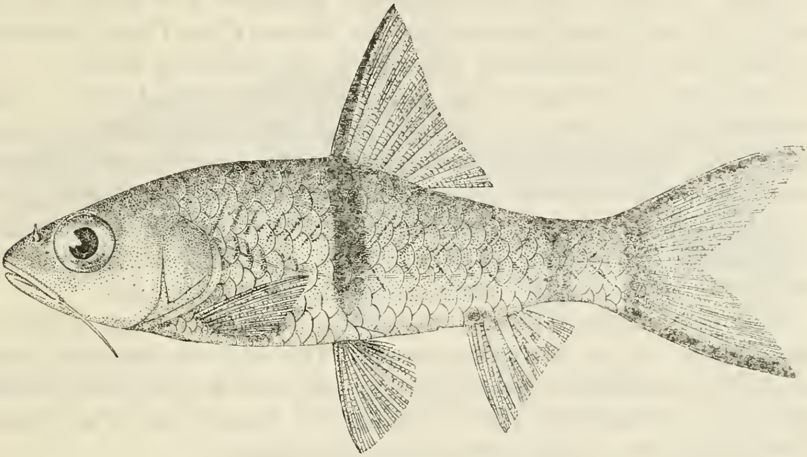


Figure 14.—*Hampala macrolepidota* van Hasselt. Drawn by Luang Masya; courtesy of the Thailand Government.

This is one of the most strikingly colored and most readily recognized of all the local cyprinoids. Adult or nearly full-grown specimens always show, on a silvery background, a blackish band or blotch extending from the base of the anterior dorsal rays nearly or quite to the base of the ventrals, and a conspicuous blue-black band along the upper and lower margin of each caudal lobe, the remainder of the caudal fin as well as the dorsal being bright red. The mouth is large, the maxillary reaching to or somewhat beyond a vertical from the front border of the eye, and there is a maxillary barbel as long as the diameter of the eye. A male fish, 22.5 cm. long, taken in the inner lake of the Tale Sap October 9, 1923, had, in addition to orange-red caudal and lower fins, the entire head and all the body scales thickly beset with minute pearllike excrescences.

The young exhibit a number of dark markings not seen in the adult. The dorsoventral blotch is always present but may be reduced to an oblong or round spot across or above the lateral line; there are also a curved black bar immediately behind the head, a black cross band in the middle of the caudal peduncle, and a narrower one at the base of the caudal fin, together with a roundish black spot on the body at the anterior base of the anal fin. In a series of 24 specimens, 3 to 5.2 cm. long, obtained by Deignan from the Meping at Chiengmai, April 22, 1935, all the marks except the dorsoventral band had become vague or had altogether disappeared at a length of 5 cm., and the characteristic adult markings on the caudal lobes began to be obvious at about 4.7 cm. The size at which the young continue to bear their juvenile markings varies with the locality or other conditions; thus a specimen, 6 cm. long, from a brook on Kao Sabap, November 2, 1927, retained the cross band on the caudal peduncle, and three fish, 7.5 to 8.3 cm. long, from the mouth of the Menam Chao Phya, November 13, 1927, had the same band, although it was becoming faint.

The normal formula for the pharyngeal teeth is 5,3,1–1,3,5. Some variations are shown in a few local specimens whose teeth have been examined. The single tooth in the third row is sometimes in such close alignment with the teeth in the second row that one could easily read the formula as 5,4–4,5. In some cases the third row is altogether absent, and the formula is then 5,3–3,5. In one specimen from the Menam Chao Phya below Bangkok the teeth are 5,3,2–2,3,5.

This fish is always given a distinctive vernacular name which, in most places, is *pla kasoop* or *kasoob*. This name is frequently contracted or corrupted into *pla soop* or *pla soób*, and in some sections into *pla soot* and *pla sood*. Among the Malay people of Patani Province the fish is called *ikan tubo* or *ikan tubu*.

HAMPALA DISPAR H. M. Smith

FIGURE 15

Hampala dispar SMITH, 1934b, p. 309, pl. 11 (Menam Mun, Nong Han; Seamreap River, Cambodia).

The type of this species (U. S. N. M. No. 103366) came from the Menam Mun at Ubon, Eastern Thailand, and all the other specimens, four in number, that have been examined likewise came from the basin of the Mekong, three from the large lake, Nong Han, at Sakon Nakon, and one from the Seamreap River, an affluent of the Tonle Sap or Grand Lake in Cambodia, French Indo-China.

The largest preserved specimen was a female 17.3 cm. long. The species, however, reaches a length of at least 20 cm.

While closely related to *Hampala macrolepidota*, this form may be distinguished by the shorter caudal fin, the enlarged lower lobe of the caudal, the short maxillary barbel (less than one-third the diameter of the eye, while in *H. macrolepidota* it is about equal to or much longer than the diameter of the eye), the absence of a well-marked marginal blackish band along each of the caudal lobes, which are diffused blackish distally, and a round black spot about the size of the eye above the lateral line between the dorsal and ventral fins. Some young examples of *H. macrolepidota* exhibit a round black spot on the side in addition to other juvenile markings, all of which disappear before the adult shape is reached. The round spot in *dispar* is characteristic of the mature fish.

At Ubon and Sakon Nakon the vernacular name for this fish is *pla soot*, apparently a contraction and variant of *pla kasoop*, the general name for *Hampala* in most parts of Thailand.

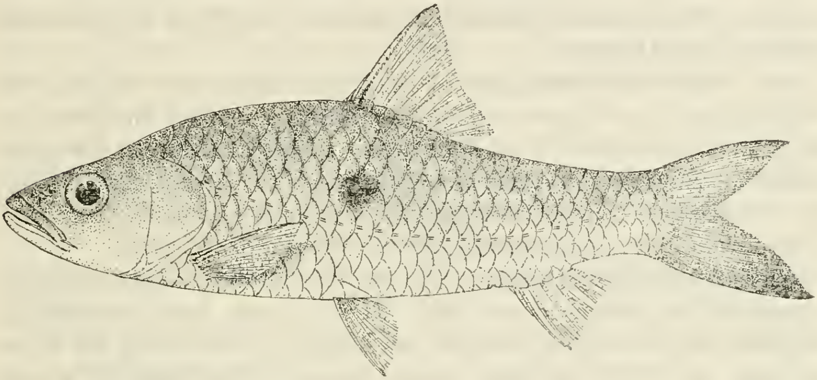


FIGURE 15.—*Hampala dispar* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

Genus CATLOCARPIO Boulenger

Catlocarpio BOULENGER, Ann. Mag. Nat. Hist., ser. 7. vol. 1, p. 450, 1898. (Type, *Catlocarpio siamensis* Boulenger.)

CATLOCARPIO SIAMENSIS Boulenger

Catlocarpio siamensis BOULENGER, 1898, p. 450 (Menam Chao Phya).—SMITH, 1931d, p. 181 (Siam, Cambodia).

Catla catla HORA, 1923b, p. 158 (Nontaburi).—VIPULYA, 1923, p. 226 (Bangkok, Menam Chao Phya).

Catlacarpio siamensis FOWLER, 1937, p. 179, figs. 116, 117 (Bangkok).

This is a fish of the large streams, but it enters ponds and canals connected with those streams. It occurs throughout the length of the Menam Chao Phya and is known from the Meklong at Rajaburi, the Bangkam at Lopburi, and the Pasak at Dha Luang. It breeds in Bung Borapet and other bungs into which the flood water from the rivers flows. In the Menam Chao Phya when the high water comes down from the north the fish go with it as far as Paknam and are often caught there in nets.

This is the largest cyprinoid fish in Thailand and one of the largest in the world. One taken at Bangkok on November 3, 1923, was 2.5

meters long, and there are other definite records of examples of this size. Fish up to 3 meters have undoubtedly been caught in the Menam Chao Phya in earlier years. A dried head, 42 cm. long, in the collection of the Siamese Bureau of Fisheries was from a specimen taken at Paknam, August 24, 1924. A scale from the side of this fish was 6.8 cm. long and 5.7 cm. wide; a scale from the back near the head was 8.5 cm. long and 8 cm. wide.

By some people the flesh of this fish is considered fairly good to eat and by others it is first pickled. Examples in most demand in the markets are those 1 or 2 feet long. On the roof of the mouth just in front of the esophagus there is a large mass of adenoid tissue, and one of the earlier Siamese kings was very fond of this substance as a food morsel.

Some idea of the abundance of the fish at times may be gathered from the fact that at one stall in one Bangkok market on December 10, 1926, 50 fish about 20 cm. long were on sale, and in one Bangkok market on November 5, 1929, over 200 fishes, the largest 22 cm. long, were on display. These fishes in both instances had come from nets in the river below Bangkok and were the young of the year.

Anglers seek large examples of this fish in the Bangkok region, using a ball of cooked rice as bait. If very large fishes are hooked, the fishermen allow their boats to be dragged around until the fishes are tired out, which may take several hours, as the fishes are strong and hardy.

All the earlier references to this fish, following Boulenger's original description, were under the name *Catla catla* (Hamilton). This error was due to the extraordinary superficial resemblance of *Catlocarpio* and *Catla*, more especially in the enormous head, which exceeds half the length of the body. *Catla* inhabits India and Burma and has not been found in Thailand but may be looked for in the Salwin Basin, from which *Catlocarpio* has not been reported. *Catlocarpio* is known from Indo-China but it is called *Catla* in the ichthyological literature of that country. A mounted specimen about a meter long, presumably from the Mekong or the Tonle Sap in Cambodia, exhibited in the Economic Museum in Pnom-Penh, Cambodia, is a *Catlocarpio* but is labeled *Catla*.

Among the outstanding differences between *Catlocarpio* and *Catla* are: The former has 14 to 16 branched dorsal rays, the latter only 9; and the former 4 pharyngeal teeth in one row on each side, the latter 10 teeth arranged in three rows on each side. Other characters of *Catlocarpio* are a very broad dermal fold bordering the gill cover, numerous gill rakers (110 on the first arch), eyes invisible from above, mouth extending as far back as eye, lower lip thick and with the postlabial groove interrupted medianly, absence of barbels, and complete lateral line with 39 to 40 scales.

The fish has a distinctive vernacular name by which it is always known as *pla kaho.*

Genus TOR Gray

Tor Gray, The illustrations of Indian zoology, vol. 2, p. 96, 1833–34. (Type, *Cyprinus tor* Hamilton=*Tor hamilton* Gray.)

The fishes of this genus are of medium to large size, with elongate, moderately compressed body, rather small head, long rostral and maxillary barbels, slightly inferior strongly curved mouth, thick continuous lips, lower lip with an uninterrupted posterior fold and with or without a median lobe, large scales, complete lateral line, gill membranes united to the isthmus, spoon-shaped pharyngeal teeth in three series, and dorsal fin with a scaly sheath at its base and 8 or 9 branched rays, the last simple dorsal ray osseous and nondenticulated.

The generic name *Tor*, with *Cyprinus tor* Hamilton as its haplotype, was used by Gray in 1833, thus antedating Rüppell's *Labeobarbus* (1837) by which name these well-marked fishes of the Asiatic mainland and the Indo-Australian Archipelago have been designated by Bleeker, Weber and de Beaufort, and others. Günther (1868, vol. 7) and Day (1878) retained these fishes in the multicomposite genus *Barbus.*

Four species are known from the rivers of Thailand, none peculiar to the country, as follows:

1*a*. Lower lip with a median lobe.
  2*a*. Lobe of lower lip reaching a line connecting corners of mouth; upper lip with a median lobe ---------- tambroides
  2*b*. Lobe of lower lip shorter, not reaching a line connecting corners of mouth; upper lip without a median lobe.
    3*a*. Depth of body 3 to 3.2 in standard length; length of last simple dorsal ray about equal to head ---------- douronensis
    3*b*. Depth of body 3.75 in standard length; length of last simple dorsal ray much shorter than head ---------- stracheyi
1*b*. Lower lip without a median lobe ---------- soro

TOR TAMBROIDES (Bleeker)

Figure 16

Labeobarbus tambroides Bleeker, 1854 (106), p. 92 (Padang, Pajakombo, Solok, Lacus Meninju, Sumatra; Tjampea, Buitenzorg, Tjipannas, Java).—Smith. 1931d, p. 183 (Petchaburi River, Tapi River).

Barbus (Labeobarbus) tambroides Hora, 1924a, p. 471 (Tale Sap).

Long known from Java, Borneo, and Sumatra, this fish in recent years has been found in widely separated parts of Thailand. It seems to be rare or uncommon wherever found in this country and is best known in Petchaburi River, where it enjoys a high reputation as a food fish, similar to that of *Probarbus jullieni* Sauvage in the Meklong.

During the dry season the fish is found in the river as far up as Ban Sarahet, which in the flood season is 5 days by poling boat or 16 hours by motor launch from Petchaburi. The adult fish descend as the floods come and go to the mouth of the river but not into the sea, remaining there 4 to 8 weeks. The fish then ascend the river and stay for several months in the section above the town of Petchaburi, laying their eggs in July near the mouths of small branches up which the young subsequently go. Other streams in which the fish has been collected for the Siamese Bureau of Fisheries are the Tapi, in the Peninsula, and the Meping at Chiengdao, in the Northern district. The British Museum contains an adult specimen collected in the Mewang in Central Siam, by Arthur S. Vernay. Hora doubtfully referred to this species the skin of a fish several feet long from the inner lake of the Tale Sap.

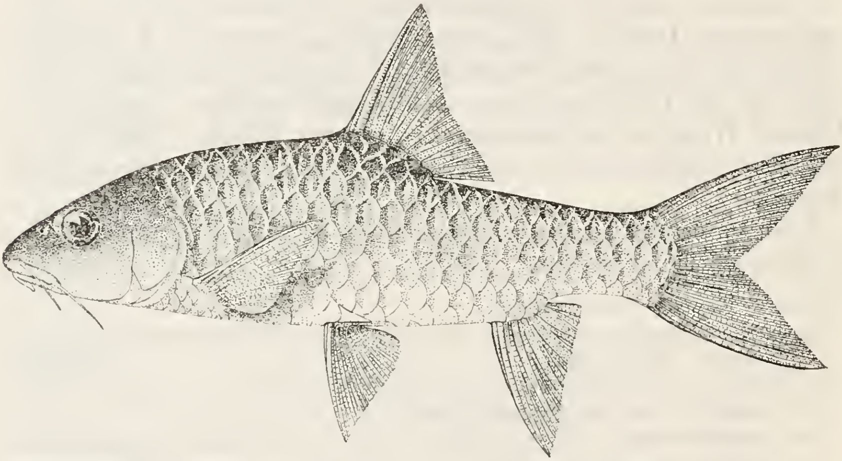


Figure 16.—*Tor tambroides* (Bleeker). Drawn by Luang Masya; courtesy of the Thailand Government.

The fish reaches a length of 70 cm. in the East Indies. The largest reported in Thailand have been about 50 cm. long, and the largest examined by the present writer have been 35 cm. long.

The flavor of the flesh of this fish is delicious and superior to that of any other fish known to the people on Petchaburi River. The supply is very limited, and in recent years not more than 20 adult fish have been caught annually at Petchaburi. The largest fish are reputed to have the best flavor, and the price obtained by the fishermen has been 6 to 8 ticals (about $2.40 to $3.20) per fish. Fishing is done with a line armed with small hooks baited with a cake made from the fruit of the sugar palm mixed with rice flour; this cake is prepared and used only for this purpose. The large scales are sometimes eaten after being cooked in boiling lard and rendered puffy.

The vernacular name on the Petchaburi River is *pla wien*, applied only to this species; on the upper Meping the fish is called *pla yard.*

TOR DOURONENSIS (Cuvier and Valenciennes)

Barbus douronensis CUVIER and VALENCIENNES, 1842, vol. 16, p. 187 (Java).
Barbus duoronensis BOULENGER, 1903, p. 303 (Patani River).
Labeobarbus duoronensis SMITH, 1931d, p. 185 (Patani River).
Labeobarbus douronensis FOWLER, 1935a, p. 120 (Srisawat).—KOUMANS, 1937a, p. 63 (Tale Sap).

This species, previously known from Sumatra, Java, and Borneo, was added to the Thailand fauna by Annandale and Robinson, who collected three specimens in the Patani River that are now in the British Museum. These specimens, recorded by Boulenger under the name *Barbus duoronensis*, came from the Patani River between Biserat and the town of Patani. Most unexpectedly, the fish was found by the writer in the Mekhan, a tributary of the Meping, in the Northern district, a specimen 31.5 cm. long being taken February 6, 1932. Another record is for Srisawat, where R. M. de Schauensee took a specimen of 14 cm. in July 1934. A specimen about 15 cm. long is recorded by Koumans from the inner lake of the Tale Sap at Patalung.

The fishermen along the Mekhan know this fish and give it a special name, *pla ngien.*

TOR STRACHEYI (Day)

Barbus stracheyi DAY, 1871, p. 307 (Akyab, Moulmein).

This fish, recorded from Akyab and Moulmein in Burma, occurs in the Salwin Basin in Thailand. An example, 22.5 cm. long, taken by the writer in the Mepai near Mehongsorn, June 27, 1932, agreed well with Day's description and plate.

The fish is not rare in the Mehongsorn district and is called *pla yard* by the local fishermen.

TOR SORO (Cuvier and Valenciennes)

FIGURE 17

Barbus soro CUVIER and VALENCIENNES, 1842, vol. 16, p. 191 (Bantam).
Labeobarbus soro SMITH, 1931d, p. 184 (Southeastern Siam).—FOWLER, 1934a, p. 119 (Metang River, Chiengmai); 1935a, p. 120 (Keng Sok).

A fish of Java and Sumatra, this species was first detected in Thailand in 1925 when a small example was taken in the waterfall stream at Pliew, on Kao Sabap.

A specimen. 15 cm. long, from the Meton on Doi Nang Ka, Northern Thailand, in May 1931, had a diffuse dark band formed by spots at the base of the two rows of scales along and above the lateral line, but was otherwise typical; lateral line 26, transverse line to base of ventral fin 35–1–2, predorsal scales 9; circumpeduncular scales 12; rostral barbel equal to diameter of eye, maxillary barbel a third longer.

Fowler reported a specimen, 5 cm. long, from the Metang, north of Chiengmai, presumably from the Meping; and two, 29 and 31.5 cm. long, from Keng Sok, in the Southeastern division.

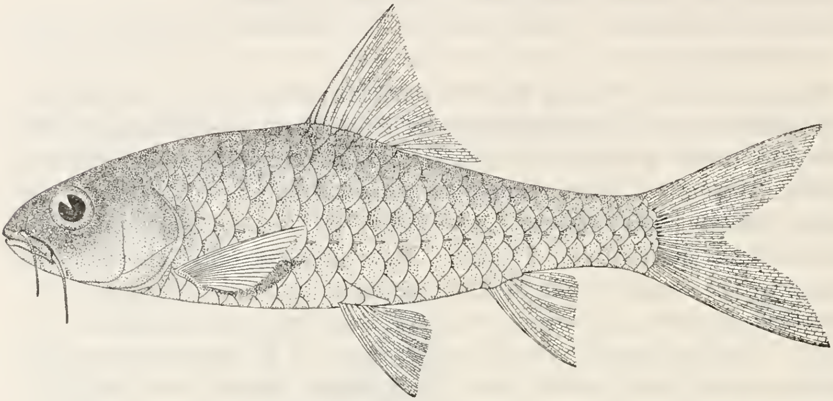


Figure 17.—*Tor soro* (Cuvier and Valenciennes). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

A single specimen, 8.2 cm. long, obtained by Deignan on October 22, 1936, from Huey Mekong Kha, a tributary of the Salwin at the base of Doi Mekong Kha, is referred to this species, otherwise not known from the Salwin. In the absence of a median lobe on the lower lip, in squamation, fin formulae, and in other characters it cannot be otherwise allocated. A double row of low, widely spaced tubercles extends from snout along cheek to under middle of eye.

In the East Indies a length of nearly 1 meter is attained.

Among the people on Kao Sabap, this fish bears the name *pla pluang hin.*

Genus CYCLOCHEILICHTHYS Bleeker

Cyclocheilichthys Bleeker (201), Nat. Tijdschr. Nederl.-Indië, vol. 20, p. 431, 1859–60. (Type, *Cyclocheilichthys armatus* Bleeker.)

The fishes of this genus are numerously represented as to species in Thailand and some are abundant and an important element in the food supply of the people living along the larger rivers. The outstanding generic characters are: Mouth small, subinferior; lips entire and continuous around corners of mouth; a continuous groove posterior to lower lip; barbels 4, 2, or none; head with numerous sensory folds in parallel groups; lateral line with less than 50 scales; 8 branched dorsal rays, last simple ray osseous and strongly denticulated. Some of the species are not sharply differentiated and are based on a combination of minor characters rather than on outstanding features such as are seen in *C. heteronema*, *C. enoplos*, and *C. apogon*. The species recorded from Thailand may be distinguished as follows:

- 1*a*. Barbels absent ------------------------------ apogon
- 1*b*. Barbels present.
  - 2*a*. Barbels maxillary.
    - 3*a*. Barbels multifid ------------------------------ heteronema
    - 3*b*. Barbels simple.
      - 4*a*. Circumpeduncular scales 16; scales in transverse series 6.5–1–6.5.
        - 5*a*. Depth 3.6; pectorals not reaching ventrals; a round blackish spot in humeral region and another at posterior end of lateral line. siaja
        - 5*b*. Depth 2.4; pectorals reaching to ventrals; a large round blackish spot at base of caudal fin ------------------------------ armatus
      - 4*b*. Circumpeduncular scales 18; scales in transverse series 5.5–1–4.5; pectorals not reaching ventrals; a blackish blotch on caudal peduncle, near caudal fin ------------------------------ coolidgei
  - 2*b*. Barbels maxillary and rostral.
    - 6*a*. Lateral line with all or some of tubules bifid or trifid; a well-marked annular gelatinous eyelid ------------------------------ enoplos
    - 6*b*. Lateral line with all of tubules simple; no annular gelatinous eyelid.
      - 7*a*. Scales in transverse series to base of ventral fin 7–1–4; least height of caudal peduncle 0.5 length of head; circumpeduncular scales 20; origin of dorsal fin nearer to base of caudal fin than to end of snout. repasson
      - 7*b*. Scales in transverse series to base of ventral fin 6–1–4 or 6–1–5; least height of caudal peduncle less than 0.5 length of head; circumpeduncular scales about 16.
        - 8*a*. Scales in transverse series 6–1–4.
          - 9*a*. Origin of dorsal fin midway between end of snout and base of caudal fin.
            - 10*a*. Gill rakers on first arch 6+11; no oblique dark bar behind gill opening ------------------------------ dumerilii
            - 10*b*. Gill rakers on first arch 4+5; an oblique dark bar behind gill opening ------------------------------ mekongensis
          - 9*b*. Origin of dorsal fin nearer to end of snout than to base of caudal fin. amblyceps
        - 8*b*. Scales in transverse series 6–1–5 ------------------------------ tapiensis

CYCLOCHEILICHTHYS APOGON (Cuvier and Valenciennes)

Barbus apogon Cuvier and Valenciennes, 1842, vol. 16, p. 392 (Java).

Cyclocheilichthys (*Anematichthys*) *apogonides* Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 175 (Siam).

Barbus (*Puntius*) *apogon* von Martens, 1876, p. 402 (Petchaburi).

Cyclocheilichthys apogon Sauvage, 1881, p. 163 (Siam).—Weber and de Beaufort, 1916, vol. 3, p. 156 (Siam).—Hora, 1923b, p. 155 (Bangkok).—Fowler, 1934b, p. 343 (Ban Thung Luang); 1935a, p. 121 (Bangkok); 1937, p. 184 (Bangkok, Mepoon, Tachin).—Koumans, 1937a, p. 63 (Kapa).—Fowler, 1939, pp. 40, 41 (Khao Bhanam Bencha, Huey Yang).

Cyclocheilichthys rubripinnis Fowler, 1934b, p. 343, fig. 7 (Ban Thung Luang); 1939, p. 70 (Trang).

The range of this species includes Java, Borneo, Sumatra, and other islands of the East Indies, Malaya, Burma, and Thailand. In local waters it is the commonest and most widely distributed species of *Cyclocheilichthys.* It has been found in the basin of the Menam Chao Phya as far north as Mepoon (Fowler); at Chantabun, Krat, in a mountain stream on Kao Sabap; in upper waters of the Menam Tapi; in the Menam Tadi; in the Tale Noi; in the Menam Patani at the town of the same name; and on the western side of the peninsula near Takuapa.

Many of the fully grown males of *C. apogon* are strikingly colored in life. At a trap at Hangkraben, off the Menam Chao Phya north of Ayuthia, this fish was being caught in large numbers on December 11, 1924, the size ranging from 11.5 to 14.2 cm.; as they came from the water they were generally silvery, with 10 or 11 very conspicuous black longitudinal stripes from the pectorals to the caudal, the stripes formed by a spot on each scale, and with a large round black spot on the caudal peduncle at the end of the lateral line; the iris was blood red; all fins were pale reddish; and the peritoneum was black. A breeding male in high coloration taken in the upper Chantabun River on June 11, 1926, was of a golden color, with the entire body marked by jet black longitudinal stripes formed by a spot on each scale, a large black spot on the caudal peduncle, dorsal and caudal fins deep rich red, anal and ventral fins pale red, pectoral fins pale green; numerous pearl organs were on the head, back, and sides.

There is little room to doubt that Fowler's *C. rubripinnis* is this species. Fowler compares it with *C. repasson*, a species with four barbels, but makes no comparison with *C. apogon*, with which it is in perfect agreement. Even the "fins all with red tinge," on which the species appears to have been largely based, is a normal feature of *C. apogon.*

Vernacular names borne by the fish are *pla nam lang*, *pla sai tan*, and *pla tapien sai* in Central Trailand; *pla sai tan* in Southeastern Thailand; and *pla chang kra*, *pla ya*, *pla tadeng*, and *pla nom* in the Peninsular district.

CYCLOCHEILICHTHYS HETERONEMA (Bleeker)

FIGURE 18

Barbus heteronema BLEEKER, 1853 (85), p. 446 (Sambas, Borneo).

This little species, formerly known only from Borneo and Malacca, was added to the list of known Thailand fishes in 1927 when, on September 26, the writer collected specimens in the Tale Noi. In July 1929 the fish was found to be very abundant there, some of the seine fishermen having large catches in their boats, and many specimens were collected. Although the Tale Noi is connected with the inner lake of the Tale Sap by several narrow canals, this species has not yet been recorded for the Tale Sap, where considerable collecting has been done.

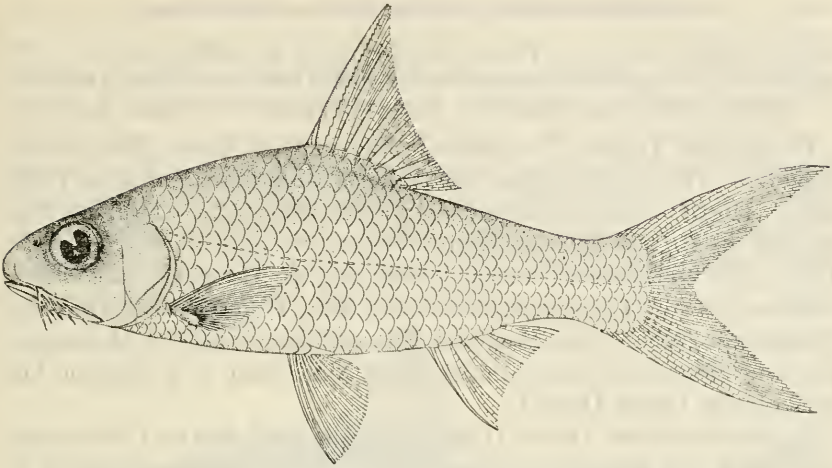


FIGURE 18.—*Cyclocheilichthys heteronema* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

The species may at once be recognized by the multifid maxillary barbels, a feature not possessed by any other member of the genus.

The maximum length attained is under 12 cm.

The local name for the fish is *pla ka ti.*

CYCLOCHEILICHTHYS SIAJA Bleeker

Cyclocheilichthys siaja BLEEKER, 1860 (265a), p. 375 (Borneo; Sumatra).

This species has heretofore been recorded from Sumatra, Borneo, and Malacca. Its inclusion in this catalog depends on a specimen 24 cm. long, taken in the Menam Chao Phya at Bangkok, October 9, 1933, which is thus identified. The specimen has a pair of maxillary barbels whose length is less than half diameter of eye, eye 3.5 in head, 39 scales in lateral line and 11 in transverse series to base of ventral (6 above and 4 below lateral line), 13 predorsal scales, 15 scales around narrowest part of caudal peduncle, caudal peduncle longer than deep with its least depth less than 0.5 length of head, a strong fourth dorsal ray whose length exceeds head, pectorals as long as and not reaching ventrals, 1.4 in head, the rays i,18, and a large dark spot on the caudal peduncle. There is thus agreement in essential features with *C. siaja* as described by Weber and de Beaufort (1916, vol. 3), with several points of difference which may be attributed to individual variation. Incidentally, although Weber and de Beaufort specify that the pectoral fins do not extend to the ventrals, in both of Bleeker's figures of this species (301) (1863, vol. 3) the pectorals are represented as reaching well behind the ventral origin.

CYCLOCHEILICHTHYS ARMATUS (Cuvier and Valenciennes)

Barbus armatus Cuvier and Valenciennes, 1842, vol. 16, p. 163 (Java).
Cyclocheilichthys armatus Weber and de Beaufort, 1916, vol. 3, p. 163 (Siam).—Fowler, 1935a, p. 121 (Khao Nam Poo); 1937, p. 186 (Pitsanulok, Kemarat).

In the East Indies this species is known from Java, Borneo, and Sumatra. It is not abundant but it has a wide distribution in Thailand. The first specimen from local waters seems to have been one that reached the British Museum from "Western Siam," collected by Bock. This is the specimen on which Weber and de Beaufort based their Siamese record. Other specimens have come from Central Thailand (Paknampo, Khao Nam Poo, and Pitsanulok); from the Mekong at Kemarat (Fowler); and from the Tale Noi, where it is common but of small size (up to 11 cm.).

In small examples (9.5 to 11 cm. long) the least depth of the caudal peduncle is less than 0.5 length of head. The fish reaches a length of 23 cm., and large specimens have the depth of the caudal peduncle more than half length of head.

This species is most readily recognized by the single pair of short maxillary barbels combined with 6.5 or 7 rows of scales above the lateral line, 4 or 5 rows of scales between the lateral line and the base of ventrals, and 15 to 18 branched rays in the pectoral fins, which extend on the ventral base.

Three additional specimens from the upper Nan River, April 19, 1930, the largest, 18 cm. long, the others about 15 cm. long, have the bases of the scales of back and sides with a black crescentic spot which is sharply contrasted.

This species at Nan is known as *pla pak liem*.

CYCLOCHEILICHTHYS COOLIDGEI, new species

Figure 19

Description.—Upper profile of head nearly straight, profile from nape to dorsal fin slightly arched; depth 3 in standard length; least depth of caudal peduncle 1.3 in its length and slightly more than 2 in head; head 4 in length; eye 3.5 in head, equal to snout and interorbital space; maxillary reaching vertical from nostrils; maxillary barbels less than 0.25 eye; gill rakers thick, fleshy, with obtuse ends, 1+5 on first arch.

Squamation: Scales in lateral line 35, in transverse line from midline of back to base of ventral fin 5.5–1–4.5, in predorsal region 13, circumpeduncular 18; well-developed scaly sheaths along the base of the dorsal and anal fins.

Fins: Dorsal origin over eleventh scale of lateral line, slightly behind ventral origin, midway between tip of snout and last scale of lateral line, dorsal rays iii, 8, last simple ray rather strong, finely serrated, and as long as head; caudal as long as head, deeply forked, lobes pointed, anal rays iii, 5, longest equal to head less snout; ventrals arising under eighth or ninth scale of lateral line, rays i, 8, longest ray 1.3 in head; pectorals equal to ventrals, not quite reaching ventral base, rays i, 15.

Coloration: Upper parts reddish brown, below silvery white; each scale of back and side with a round, dark brown spot at base, the spots forming faint longitudinal lines of which three or four along middle of side are the most distinct; an obscure dark blotch on caudal peduncle near base of caudal fin; dorsal fin with blackish edge and blackish membranes; caudal fin dusky; other fins plain.

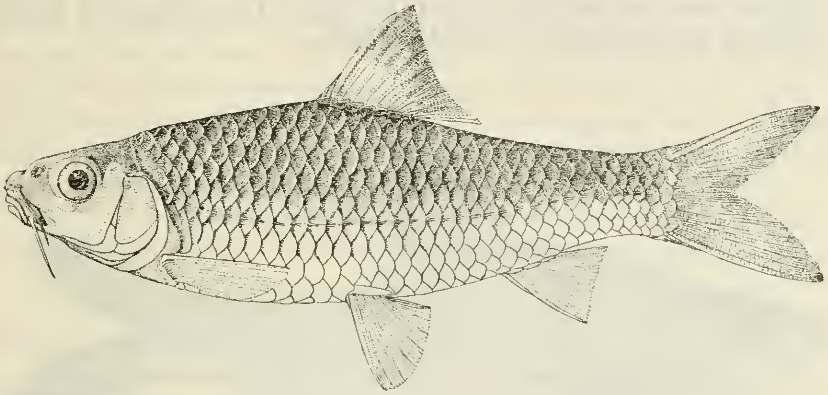


Figure 19.—*Cyclocheilichthys coolidgei*, new species: Type (M.C.Z. No. 35519). Drawn by Mrs. Aime M. Awl.

Type and paratypes.—The type, an ovigerous female, 10.6 cm. long, collected April 27, 1937, by the Harvard Primate Expedition at Chiengmai, Northern Thailand, is in the Museum of Comparative Zoology (M. C. Z. No. 35519). Sixteen other specimens, 6.8 to 10.8 cm. long, taken at the same time and place, are paratypes. Those in the U. S. National Museum are U. S. N. M. Nos. 118452, 118453.

Remarks.—This is a very small species, reaching full maturity and spawning when less than 7 cm. long. The maximum size among the specimens in hand is 10.8 cm. The smallest is a male 6.8 cm. long with well-developed gonads.

This species is close to *C. armatus.* Agreement is seen in the number of scales in the lateral and transverse series, in the single small maxillary barbel, and in the fin formulae. Differences are chiefly in the body proportions and in the number of circumpeduncular scales. In *C. armatus* the body is deeper and the head is longer, the caudal peduncle is deeper, and there are always 16 circumpeduncular scales as against an invariable count of 18 in the present species.

Named in honor of Harold J. Coolidge, Jr., leader of the Harvard Primate Expedition, who made the interesting collection of fishes in

Northern Thailand, of which the excellent series of this species forms a part.

CYCLOCHEILICHTHYS ENOPLOS (Bleeker)

FIGURE 20

Barbus enoplos BLEEKER, 1850 (25), p. 16 (Kalimas River, Surabaya, Java).

Cyclocheilichthys macracanthus BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 175 (Siam).

Cyclocheilichthus enoplos WEBER and DE BEAUFORT, 1916, vol. 3, p. 158 (Siam).—FOWLER, 1935a, p. 121 (Bangkok); 1937, p. 184 (Bangkok).

The range of this species covers Java, Sumatra, and Thailand. It is known from the entire length of the Menam Chao Phya, the Pasak and other large tributaries, and the Meklong.

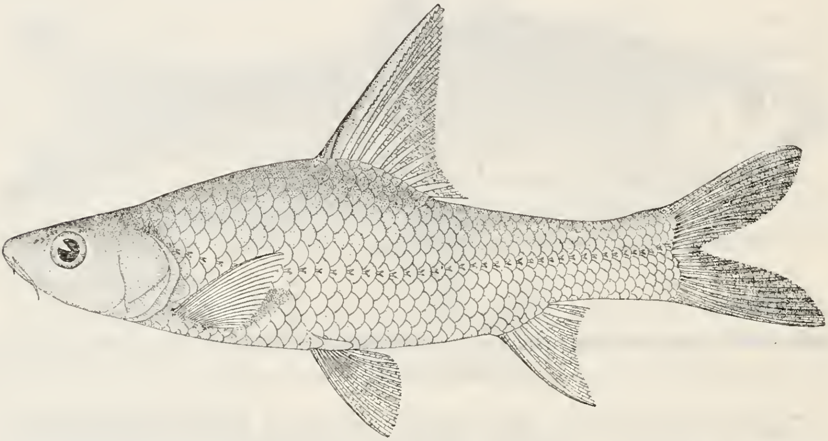


FIGURE 20.—*Cyclocheilichthys enoplos* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

It is the largest member of the genus. A length of 45 cm. is attained in Sumatra, and examples of that size are not uncommon in the Menam Chao Phya. A specimen taken in the head of that river at Paknampo January 7, 1925, was 57 cm. long.

What may be regarded as typical specimens have all the lateral-line tubes bifid. There is considerable variation in this character, however. Some examples may show only a single scale with a bifid tube, and some may have the bifid tubes only or mostly on the anterior scales. In two specimens 22 cm. long taken by me in the Menam Chao Phya at Nontaburi on December 28, 1925, some of the tubes were bifid and some trifid.

It is called *pla takok* throughout its local range.

This fish is considered excellent eating.

CYCLOCHEILICHTHYS REPASSON (Bleeker)

Barbus repasson BLEEKER, 1853 (76), p. 295 (Panguabang, Sumatra).
Cyclocheilichthus repasson WEBER and DE BEAUFORT, 1916, vol. 3, p. 160 (Siam).—FOWLER, 1937, p. 186 (Tachin, Mepoon, Pitsanulok).

The range of this species covers Java, Borneo, Sumatra, and Thailand. It is widely distributed in Central Thailand (Menam Chao Phya and tributaries, Meklong), Northern (Mekok at Chiengrai), and Peninsular Thailand (upper Tapi, Tale Sap, and Patani River).

The prominent distinguishing features are strongly arched dorsal profile, deep body (about 2.6 times in standard length), flat interorbital space exceeding diameter of eye, 4 small barbels, postlabial groove on lower jaw not interrupted medianly, 7 scales above lateral line and 4 below lateral line to base of ventral, 20 scales around the narrowest part of caudal peduncle, very strong osseous fourth simple dorsal ray, origin of dorsal fin nearer to base of caudal than to tip of snout, conspicuous longitudinal black stripes formed by spots on the scales, and a large round black spot on the caudal peduncle.

While in the Dutch East Indies the fish reaches a length of 28 cm., the largest met with in Thailand have been only 16 cm. long.

CYCLOCHEILICHTHYS DUMERILII Sauvage

Cyclocheilichthys (*Cyclocheilichthys*) *dumerili* BLEEKER, 1865 (347), p. 37 (nomen nudum) (Siam); 1865 (356), p. 175 (nomen nudum) (Siam).
Cyclocheilichthys dumerilii SAUVAGE, 1881, pp. 163, 182 (Bangkok).—HORA, 1923b, p. 154 (Bangkok, Nontaburi).—FOWLER, 1937, p. 186 (Bangkok, Mepoon, Tachin, Kemarat).

In the Pakret section of the Menam Chao Phya this fish was very common in December 1924, the bulk of the cast-net catch at that time consisting of it and *Cosmochilus harmandi* Sauvage.

The type was 16 cm. long. The largest fish observed in recent years were 18.5 cm. long.

While this species has sometimes been ascribed to Bleeker, it was first described by Sauvage in 1881, 16 years after Bleeker had thus labeled a specimen in the Paris Museum collected at Bangkok by Dr. Bocourt.

Fowler (1937), in referring to numerous specimens in his possession from Central and Northern Thailand, was in error in stating that "this interesting species does not seem to have been seen since originally described in 1881." In addition to the specimens from the Menam Chao Phya at Bangkok and Nontaburi examined by Hora (1923b), the fish has been collected for the Siamese Bureau of Fisheries at various places in the Menam Chao Phya between Bangkok and Ayuthia, and also in the Samrong Canal (connecting the Menam Chao Phya with the Menam Bangpakong).

The characters on which Sauvage separated this species from *C. armatus*, namely, "les écailles un peu plus petites, le profil rostrodorsal mois incliné," in reality do not exist. Sauvage gave 38 scales in the lateral line of his one example of *C. dumerilii* as against 33 to 36 in *armatus*, a difference of little significance, which disappears entirely when put against the presence of 30 to 36 scales in the lateral line of Thailand examples of *C. dumerilii* (Fowler). The steepness of the rostrodorsal profile, which would determine the depth of the body, varies with age; although in specimens of *C. armatus* of the approximate size of the type of *C. dumerilii* the body is somewhat deeper.

If *C. dumerilii* is separable from *C. armatus*, its distinctive features would seem to be the constant possession of two pairs of well-developed barbels (as against a single pair of maxillary barbels normally in *C. armatus*, with a rudimentary pair of rostral barbels occasionally present), and the slenderer caudal peduncle, its least depth contained 2.35 to 2.75 times in head (as against 1.75 to 1.85 times in *C. armatus*). Furthermore, while *C. dumerilii* has no large round spot on the caudal peduncle and no longitudinal rows of dark spots (one on each scale of back and sides), these markings are always present in *C. armatus*.

The usual indigenous name for this fish is *pla nam lang* (*nam lang*, back spine), but in places one hears the name *pla takok*, both applied also to other species of *Cyclocheilichthys*.

CYCLOCHEILICHTHYS MEKONGENSIS Fowler

Cyclocheilichthys mekongensis FOWLER, 1937, p. 187, figs. 126, 127 (Kemarat, Pitsanulok).

This species is based on numerous specimens from the Mekong at Kemarat. Additional material was from the Nan River at Pitsanulok. There are 4 short barbels, 34 or 35 scales in the lateral line, close-set transverse sensory folds covering the entire surface of the head, an oblique dark bar along the upper part of the gill opening, no conspicuous longitudinal dark lines on the back and side, and no dark blotch on the caudal peduncle.

A length of 15 cm. is attained.

CYCLOCHEILICHTHYS AMBLYCEPS Fowler

Cychlocheilichthys amblyceps FOWLER, 1937, p. 187, figs. 140, 141 (Bangkok).

Known from two specimens, apparently young, 10.4 and 9 cm. long, from Bangkok. The snout is relatively short and the eye is relatively large, as is characteristic of young cyprinoid fishes. With only two specimens, Fowler makes an enigmatic remark about the barbels: "Barbels minute to vestigial or even absent, rostral always smaller or shorter, maxillary barely ¼ of eye."

The species is very close to *C. armatus*.

CYCLOCHEILICHTHYS TAPIENSIS H. M. Smith

FIGURE 21

Cyclocheilichthys tapiensis SMITH, 1931a, p. 11, fig. 5 (Tapi River, Bandon Bight).

This fish is known from six specimens collected in September 1923 at several places on the Tapi River and in Bandon Bight off the mouth of that river in the Gulf of Siam.

The type is 13 cm. long, and the largest of the examples examined is 16 cm., which represents about the maximum size attained, according to the local fishermen.

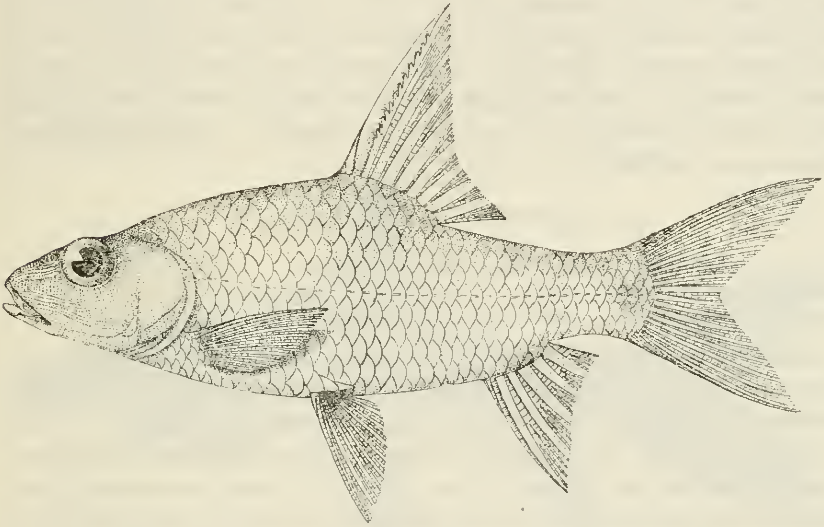


FIGURE 21.—*Cyclocheilichthys tapiensis* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Governmet.

The species is not very strongly separated from *C. dumerilii* as inadequately described by Sauvage and as described in greater detail by Fowler with a number of points of difference. The two forms may perhaps be separated by the following characters: A depression at the nape in *C. tapiensis*, none in *C. dumerilii;* interorbital space concave and equal to diameter of eye in former, convex and 1.3 to 1.5 times diameter of eye in latter; lines of sensory pores include conspicuous longitudinal groups on snout and cheek in former, while in latter all the lines are said to be transverse; 5 rows of scales between the lateral line and the ventral base in *C. tapiensis*, 4 in *C. dumerilii;* fourth simple dorsal ray stout and with 13 antrorse teeth in former, slender with 24 antrorse teeth in latter; and caudal peduncle with a more or less conspicuous round dark spot in former and none in latter.

The names by which the fish is called are *pla kamprad* (slippery fish), *pla fa*, and *pla fa hin.*

Genus OREICHTHYS H. M. Smith

Oreichthys H. M. SMITH, Journ. Siam Soc., Nat. Hist. Suppl., vol. 9, p. 63, 1933. (Type, *Oreichthys parvus* H. M. Smith.)

The genus *Oreichthys* was established (Smith, 1933a) for the reception of a little fish collected in a small brook on Kao Sabap, an extensive mountain mass near Chantabun. The genus is close to *Cyclocheilichthys* but differs in having the last simple dorsal ray nonosseous and nondenticulated (as against strongly osseous and denticulated in *Cyclocheilichthys*), the scales much fewer than in any species of *Cyclocheilichthys* (only 23 in lengthwise series and 7 in transverse series), and the tube-bearing scales of the lateral line restricted to the first 6 or 7 scales anteriorly (as against a complete lateral line in *Cyclocheilichthys*). The head is marked by numerous fine rows of pores, mostly in parallel groups on snout, cheeks, interorbital space, and opercles, which are so markedly developed in *Cyclocheilichthys*. There are no barbels.

OREICHTHYS COSUATIS (Hamilton)

Cyprinus cosuatis HAMILTON, 1822, p. 338 (Kosi River).
Oreichthys parvus SMITH, 1933a, p. 63, pl. 2, fig. 1 (Ban Ang).
Oreichthys cosuatis HORA, 1937e, p. 321, fig. 1 (India).

Of 26 specimens of *Oreichthys cosuatis* taken in November and December 1927 and January 1929, the largest was 3.4 cm. long, which is about the maximum size known to the local mountain people.

This is a widely distributed Indian species and apparently reaches a maximum size of 7.5 cm. in that country. Very exceptionally in Indian examples the lateral-line tubes extend to the twentieth scale with several interruptions; but the usual number of tube-bearing scales is four or five.

Hora (1937e) concluded from a study of *Cyprinus* (*Cabdio*) *cosuatis* Hamilton (1822, p. 338) and an examination of paratypes of *Oreichthys parvus* that the latter is the young. (Paratypes in the U. S. National Museum collection are U.S.N.M. No. 108050.) Hora's judgment in this matter is unreservedly accepted.

Genus PROBARBUS Sauvage

Probarbus SAUVAGE, Bull. Soc. Philom. Paris, ser. 7, vol. 4, p. 232, 1880. (Type, *Probarbus jullieni* Sauvage.)

The genus *Probarbus* was described as new by Sauvage in 1880 and was again described as new in almost identical language in 1881, the latter account having a somewhat amplified description of the genotype and being accompanied by a plate. The type specimen was cited as 34 and 53 cm. long in the two papers. The genus was rather inadequately defined and was not differentiated from related genera, but is undoubtedly quite distinct. An outstanding feature is the presence of a single row of four pharyngeal teeth; this is combined with a pair of short maxillary barbels, a dorsal fin having nine branched rays, and a stout, osseous, undenticulated simple ray.

PROBARBUS JULLIENI Sauvage

FIGURE 22

Probarbus jullieni SAUVAGE, 1880, p. 232 (Laos, French Indo-China); 1881, pp. 163, 185, pl. 5, fig. 1 (Laos, French Indo-China).—SMITH, 1931d, p. 182 (Menam Chao Phya, Meklong).

After *Probarbus jullieni* was first brought to notice, presumably from the Meklong, the fish seems to have been met with rarely, if at all, until 1923, when the writer discovered it in Thailand. It is interesting to note that the known range has recently been extended to the Malay Peninsula. Herre and Myers (1937) record a specimen 38.5 cm. long from Perak, one of the Federated Malay States.

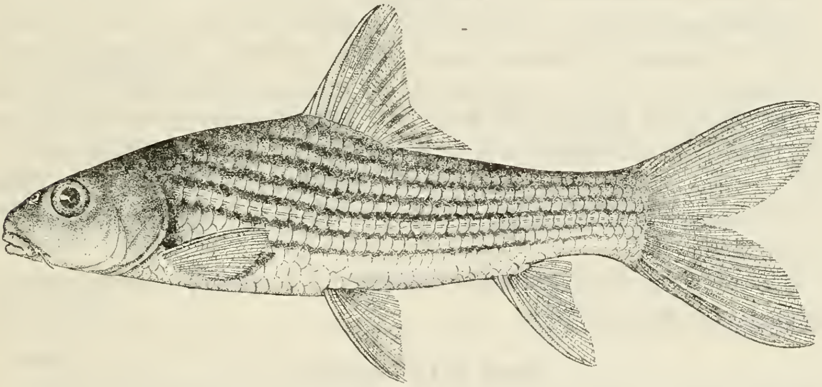


FIGURE 22.—*Probarbus jullieni* Sauvage. Drawn by Luang Masya; courtesy of the Thailand Government.

This fish has a peculiar local distribution, being known only from the Menam Chao Phya and one of its tributaries (the Pasak) and the Meklong. It has always been more numerous in the Meklong, which is a stream with much sandy bottom, while the Menam Chao Phya has mostly muddy bottom. Not much information has been gathered in regard to early abundance, but for at least 65 years the fish has been comparatively scarce. At the present time probably the deep, clear waters of the Kwe Noi, or west branch of the Meklong, are its favorite haunts.

In the Meklong the fish reaches a length of a meter. The largest actually seen by the writer was 86 cm. long; this, examined alive at Rajaburi, had been caught on a hook baited with a ball of cooked rice. and was offered for sale at 10 ticals. Another fish, 60 cm. long, seen at Sai Yok while still alive, had been taken on a worm-baited hook.

Usually, however, the examples that reach the markets are obtained with set lines, cast nets, and other nets. The usual size of those caught is 25 to 30 cm. .The smallest fish seen by the present author, taken in the Meklong at Ban Pong on November 25, 1924, was 18.2 cm. long.

The life colors are distinctive and attractive. A specimen, 60 cm. long, taken near Sai Yok on the Kwe Noi on September 23, 1929, had the body a rich creamy yellow with 7 narrow, longitudinal black stripes, the head bright greenish yellow, the iris red, the dorsal, anal, ventral, and pectoral rays pink and membranes blackish, and the caudal blackish.

Not much is known of the habits of this fish. Its mouth is very protractile like a sucker's, and its food is chiefly water plants. The intestines of one, about 35 cm. long, taken in the Meklong at Rajaburi December 4, 1925, were filled with vegetable material. Although the fish is found near the mouths of the two large rivers mentioned, it never enters salt water. It is said to spawn near Rajaburi, but there is no definite information on this point.

In Thailand this fish is very highly esteemed as food, and on the Meklong it is the most celebrated local species, yielding the fishermen two to three times the price commanded by *Lates calcarifer* (Bloch), which is the standard high-grade fish. In 1923 a government official at Rajaburi paid 17 ticals for a large fish, at the rate of a tical per 1.2 km. (a tical at that time being worth about 40 American cents). The fish is always in such demand that the fishermen quickly dispose of their catch.

Wherever this fish is known in Thailand it is called *pla eesok*, a name given to no other species.

Genus RAIAMAS Jordan

Raiamas Jordan, Proc. Acad. Nat. Sci. Philadelphia, vol. 70, p. 344, 1919. (Type, *Cyprinus bola* Hamilton.)

RAIAMAS BOLA (Hamilton)

Cyprinus bola Hamilton, 1822, pp. 274, 385 (the Brahmaputra).
Barilius bola Fowler, 1934a, p. 141 (Chiengsen).

This species was reported by Fowler from the Mekong at Chiengsen, three specimens 22.2 to 31 cm. being available. This is the only local record. The previously ascribed range is Burma, Assam, Bengal, Orissa, and the Northwest Provinces of India. In Assam a weight of 5 pounds has been reported, and the fish there ranks high for its gamy qualities.

It may be pointed out that whereas the lateral-line scales are stated by Day as 88 to 94, Fowler gives 48. If the latter figure is not an error, another species must be involved, probably *Barilius guttatus* (Day); and *R. bola* must be considered a very doubtful Thailand species.

In general appearance, coloration, structure, and habits this fish is a *Barilius*. Its scales are finer than in any known species of *Barilius;* its mouth is larger and extends farther backward than in any bariliid species except possibly *guttatus;* there are no barbels; and the large, broad third suborbital bone is placed entirely behind the eye. These differences, however, are of specific rather than generic significance. The most distinctive feature, and the one justifying separation from *Barilius*, is the presence of only two rows of pharyngeal teeth, with 5 teeth in the outer row and 2 in the inner row, as against three rows of teeth in all the species of *Barilius* for which information on this point is available.

Günther (1868, vol. 7) established the genus *Bola* for the accommodation of this species, overlooking or ignoring the fact that Hamilton in 1822 had used the name *Bola* in another connotation. Jordan (pt. 2, 1919, p. 344) proposed the name *Raiamas.*

Genus ROHTEE Sykes

Rohtee SYKES, Proc. Zool. Soc. London, 1838, pt. 6, p. 161, 1839. (Type, *Rohtee ogilbyi* Sykes.)

The citation of this genus in Jordan's Genera of Fishes (1919a, pt. 2, p. 210) is inaccurate in every respect. As the matter is of more than academic interest, this opportunity will be taken to give correct references. The paper by Sykes is listed by Jordan among papers published in 1841, and the reference is as follows:

> Sykes (1840). *The Fishes of Dukhun.* Ann. Mag. Nat. Hist., IV, William Henry Sykes;
>
> *Rohtee* Sykes, II, 364; orthotype R. VIGORSI Sykes. Replaces OSTEOBRAMA Heckel.

The first publication of a paper in which the name *Rohtee* appears was by Sykes in the Proceedings of the Zoological Society of London, 1838, pt. 6, p. 161, 1839, meeting of November 27, 1838, issued in May 1839 (*fide* Sherborn, Index Animalium). The title of the paper was not as cited but was "On the Fishes of the Deccan" (in table of contents). Jordan's reference to "Ann. Mag. Nat. Hist., IV" is incorrect, as the Annals and Magazine of Natural History had not been established at the date shown. The Annals of Natural History, vol. 4, for 1840, contain (pp. 54–62) the identical paper that had appeared in Proc. Zool. Soc. London, 1838, pt. 6, but the internal evidence indicates that it was published in September 1839. Jordan's reference to "II, 364" is to Transactions of the Zoological Society of London, 1841, vol. 2, pp. 349–378, where the article appeared under the title "On the Fishes of the Dukhun." In none of the three papers is there an indication or suggestion that *Rohtee vigorsi* is the orthotype. The first reviser, Bleeker (1863 [314]), made "*R. ogilbyi*" the genotype. *Rohtee* cannot "replace" *Osteobrama* because it appeared four years earlier.

ROHTEE ALFREDIANA (Cuvier and Valenciennes)

Leuciscus alfredianus Cuvier and Valenciennes, vol. 17, p. xvi, pl. 488, 1844.
Leuciscus duvaucelii Cuvier and Valenciennes, vol. 17, p. 77 (not p. 95), 1844 ("Nepaul").

This widely distributed fish of India and Burma has not heretofore been recorded from Thailand but was, of course, to be expected in the Salwin Basin. Two specimens 7.5 and 7.7 cm. long were taken by the writer January 23, 1933, at Mesarieng, in the Meyuam, a tributary of the Salwin.

Day (1878) gave the lateral-line scales as 55 to 70 in *R. cotio*, of which he regarded *alfrediana* as a variety, but his plate of the latter shows 45 scales as in the Thailand specimens at hand.

In India the fish attains a length of 15 cm. or more.

Genus BARILIUS Hamilton

Barilius Hamilton, Fishes . . . River Ganges, p. 384, 1822. (Type, *Cyprinus barila* Hamilton.)

The bariliids are conspicuous in the fauna of India, Burma, and Thailand but are lacking in the Indo-Australian Archipelago. They are for the most part fishes of hill or mountain streams, although some species inhabit lowland waters. In life they are silvery and usually have dark spots or bands on the body.

Eight species, as keyed below, are definitely recognized in Thailand; several others have an uncertain status.

1*a*. Two pairs of barbels (rostral and maxillary).
  2*a*. Scales in lateral line 31; scales between midline of back and lateral line 6.5 or 7.5; scales between lateral line and origin of ventral fin 3; predorsal scales 17; circumpeduncular scales 12; origin of dorsal fin well in advance of anal; barbels less than 0.5 eye; body with 6 or 7 irregular blue-black cross bands, a large black blotch on caudal peduncle at base of fin, a black spot on midlength of anterior dorsal rays____________ **bernatziki**
  2*b*. Scales in lateral line 32 to 37.
    3*a*. Scales in lateral lines 32 to 34; scales between midline of back and lateral line 6.5; scales between lateral line and base of ventral fin 2.5; predorsal rays 17 or 18; circumpeduncular scales 14; rostral barbel 0.75 diameter of eye; origin of dorsal fin slightly in advance of anal fin, midway between tip of snout and posterior end of central caudal rays; dorsal rays iii, 7; about 9 black spots along side of body, the anterior spots taking form of vertical stripes______________________ **nanensis**
    3*b*. Scales in lateral line 35 to 37; scales between midline of back and lateral line 7.5; scales between lateral line and origin of ventral fin 1; predorsal scales 16; circumpeduncular scales 12; rostral barbel 0.2 diameter of eye; origin of dorsal fin far in advance of anal, midway between tip of snout and base of caudal fin; dorsal rays iii, 7 or iii, 8; 12 to 14 narrow blackish vertical stripes crossing a black stripe extending from head to base of caudal fin______________________________ **huahinensis**

2*c*. Scales in lateral line 38 to 43; scales between midline of back and lateral line 7.5 or 8.5; scales between lateral line and origin of ventral fin 2.5 or 3; circumpeduncular scales 14.

  4*a*. Origin of dorsal fin very slightly in advance of anal; predorsal scales 21 to 25; body with 7 to 10 blackish transverse bands becoming roundish on caudal peduncle and often extending across lateral line anteriorly; membranes of dorsal fin almost entirely black; caudal fin unmarked-- **pulchellus**

  4*b*. Origin of dorsal fin far in advance of anal; predorsal scales 10; body with 10 to 12 blackish transverse bands becoming roundish on caudal peduncle and extending across lateral line; membranes of dorsal fin blackish along edges of rays in middle part of fin; caudal fin with 3 obscure dark cross bands------------------------------ **infrafasciatus**

1*b*. No barbels, or a pair of maxillary barbels sometimes present in one species.

  5*a*. Barbels absent; origin of dorsal fin well in advance of anal fin.

    6*a*. Scales in lateral line 34; maxillary extending under anterior border of eye; 2 blackish cross bands on anterior part of body-------- **koratensis**

    6*b*. Scales in lateral line 45; maxillary extending under center of eye; 12 steel-blue cross bands on body-------------------------------- **ornatus**

  5*b*. A pair of short maxillary barbels present or absent; dorsal fin entirely in advance of anal fin; scales in lateral line 44 to 48; maxillary extending well beyond eye; several more or less irregular lengthwise rows of small dark spots on back and side; lower lobe of caudal fin with a broad dark submarginal longitudinal band-------------------------------- **guttatus**

BARILIUS BERNATZIKI Koumans

Barilius bernatziki Koumans, 1937a, p. 61, fig. 1 (Kapa).

The only species of *Barilius* thus far recorded from Peninsular Thailand is this one from the western part of the Peninsula north of the island of Pucket.

The type and only known specimen is 10.7 cm. long.

The species seems well differentiated, having as an outstanding feature only 31 scales in the lateral line, a lower number than in any other species. The figure in Kouman's paper does not agree with the description in the number of scales in the transverse series, the relative length and depth of the caudal peduncle, the length of the barbels, the point of origin of the dorsal fin, and the length of the anal rays.

BARILIUS NANENSIS, new species

Figure 23

Description.—Dorsal profile from snout to dorsal fin nearly straight and but little inclined; ventral outline moderately and regularly decurved from mouth to caudal peduncle; depth 3.3 in standard length; least depth of caudal peduncle 1.5 in its length and somewhat less than 0.5 head; head 4.2 in length; eye about 3.2 in head, slightly less than interorbital space; snout 0.8 eye; mouth very oblique, maxillary extending to a point under anterior edge of eye, tip of lower jaw when mouth closed on level with middle of pupil, postsymphyseal knob and corresponding emargination moderately developed; 4 barbels, the rostral 0.75 eye, the maxillary 0.25 as long as rostral; gill rakers 1+7, short, widely spaced; pharyngeal teeth 5, 4, 2, long, slender, uncinate.

Squamation: Tube-bearing scales in lateral line 33, scales between lateral line and origin of dorsal fin 6.5, scales between lateral line and origin of ventral fin 2.5 or 3; predorsal scales 18, scales surrounding narrowest part of caudal peduncle 14; all scales with numerous conspicuous horizontal striae.

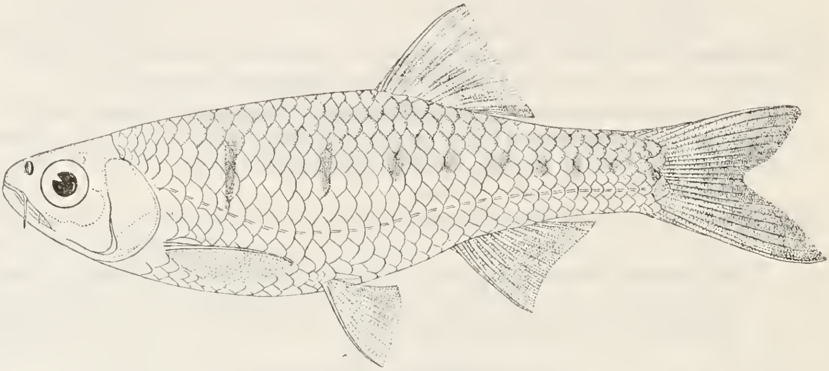


Figure 23.—*Barilius nanensis*, new species: Type (U. S. N. M. No. 107940). Drawn by Mrs. Aime M. Awl.

Fins: Origin of dorsal fin midway between tip of snout and posterior end of central caudal rays, over fourteenth scale of lateral line; free edge of fin truncate; dorsal says iii, 7, longest branched ray 1.4 times in head; caudal forked for about half its length, lower lobe longer and about equal to head; anal fin beginning under fourth branched dorsal ray, its edge slightly emarginate, anal rays iii, 10, longest branched ray somewhat more than 0.5 head; ventral fin 1.5 in head, the rays i,7; pectoral fin 1.2 in head, the rays i, 9.

Coloration: Generally silvery; nine black spots along side between head and base of caudal, the first two most distinct and persistent and having the form of short, narrow, vertical stripes, others more or less rounded; dorsal membranes hyaline, the rays below a horizontal line from middle of first ray to tip of last ray blackish green; caudal green, rays narrowly margined with black; other fins plain.

Type and paratypes.—The type (U.S.N.M. No. 107940) is a mature female, 7.2 cm. long, taken by H. G. Deignan on March 31, 1936, in the Nan River at Ban Pa Khwang, Northern Thailand. Four other specimens (paratypes, U.S.N.M. Nos. 107939, 119474–119476) from 6.2 to 7.1 cm. long were taken in the same place as the type. All are females with eggs well developed.

Other specimens.—A further lot of specimens collected by Deignan in the Menam Kon, a branch of the Menam Nan, April 21, 1936, consists of six fish 8.3 to 8.8 cm. long. They are typical in showing two to three sharply defined black vertical stripes anteriorly, with the posterior spots more or less indistinct.

Referable to this species are specimens in the Deignan collection, 5.5 and 4.8 cm. long, taken in the gorge of the Mechem in Northern Thailand, July 1935, by A. R. Buchanan and P. D. Harrisson, of Chiengmai.

Remarks.—This is one of the smallest of the known species of *Barilius* of Thailand, Burma, and India, the females reaching full sexual maturity when only 6.2 cm. long.

Its relations with other local species are shown in the preceding key. It is distinguished by a combination of characters shared by other species and by several peculiar features, including the coloration of the dorsal fin with each branched ray black basally, the extent of the blackish coloration increasing from before backward, so that the last ray is almost entirely blackish.

The paratypes agree very closely with the type in all details of structure, with slight variations that are to be expected. Thus, the tube-bearing scales of the lateral line number 32 to 34, the predorsal scales 17, the scales surrounding the caudal peduncle uniformly 14, and the branched anal rays uniformly 10.

BARILIUS HUAHINENSIS Fowler

Barilius huahinensis Fowler, 1934b, p. 347, figs. 9, 10 (Ban Thung Luang).

Known from many specimens, the largest 9.1 cm. long, from Ban Thung Luang, near the seaside resort of Hua Hin, on the west coast of the Gulf of Siam.

The coloration of young and adult is peculiar in showing 12 to 14 narrow black vertical stripes along side, a straight black median stripe from head to base of caudal fin, and, in the adult, about 4 curved, parallel dark lines on the back formed by a spot at the base of each scale. The adult has both rostral and maxillary barbels; the young appears to lack the maxillary pair.

BARILIUS PULCHELLUS H. M. Smith

Barilius pulchellus Smith, 1931a, p. 17, fig. 8 (Mekang).
Barilius buddhae Fowler, 1934a, p. 142, fig. 116 (Chiengdao, Chiengmai).

Described from four specimens taken from the Mekang at Pang Chao, on Doi Angka, Northern Thailand, on December 1, 1928, this species has been found to be abundant in various other waters in the drainages of the Menam Ping and the Menam Kong. The collection of the National Museum contains over 100 specimens obtained by H. M. Smith and H. G. Deignan in 1934, 1935, and 1936. These came from Huey Melao, a brook on Doi Hua Mot; Menam Lu and other branches of the Mechem (tributary to the Meping), collected by A. R. Buchanan; the Menam Kok, an affluent of Menam Mao and small affluents of the Menam Fang (tributary to the Mekong); and Huey Nam Puat, a tributary to the Mekong in French Laos.

In a lot of four specimens 5.1 to 6.4 cm. long from Huey Melin, a brook flowing into the Menam Mao, the two largest fish show a narrow black edge on the outer ventral rays but apparently differ in no other way from typical examples.

This is a small fish, apparently getting little larger than 10.5 cm. One of the topotypes was a female 7 cm. long with well-developed ova.

The species seems normally to have four barbels, of which the rostral pair are always the longer. The barbels are, however, subject to variation. The length of the rostral barbels ranges from one-half to one eye diameter. In some series the maxillary barbels are invariably present; in other lots (as in a series of three specimens from Huey Nam Puat, just over the border of Siam in French Laos) the maxillary barbels are absent; and in a series of 5 specimens taken by Deignan in the Huey Nam Hu Puang, an affluent of the Menam Mao, December 25, 1936, the maxillary barbels are absent on either one side or both sides.

It would appear that *Barilius buddhae* Fowler is this species. The body proportions, squamation, fin formulae, origin of the dorsal fin slightly posterior to origin of anal, etc., are in agreement. The coloration is not essentially different, and among a large series of specimens of *B. pulchellus* some are found that closely approach or entirely conform with the markings described in *B. buddhae.*

Among the mountain people of Thailand this fish shares with others of the genus the name *pla nam muk* (ink fish), probably in allusion to the black blotches on the sides and the jet-black interradial membranes of the dorsal fin.

BARILIUS INFRAFASCIATUS Fowler

Barilius infrafasciatus Fowler, 1934a, p. 141, figs. 114, 115 (Metang).

Known from a number of specimens taken in the Metang, a tributary of the Meping, in Northern Thailand.

The type and longest example is 10 cm. long.

Fowler suggests that this form may be Sauvage's most inadequately described *B. ornatus* (q. v.), but the differences are too marked to warrant the union of the two.

BARILIUS KORATENSIS H. M. Smith

Figure 24

Barilius koratensis Smith, 1931a, p. 16, fig. 7 (Menam).

Known from a single specimen, 6 cm. long, from the Menam Mun at Ta Chang, in Korat Province, this fish is easily recognizable by the absence of barbels, the insertion of the dorsal fin almost wholly in advance of the anal, and the presence of two black vertical bars on the side, one over the pectoral, one under the dorsal.

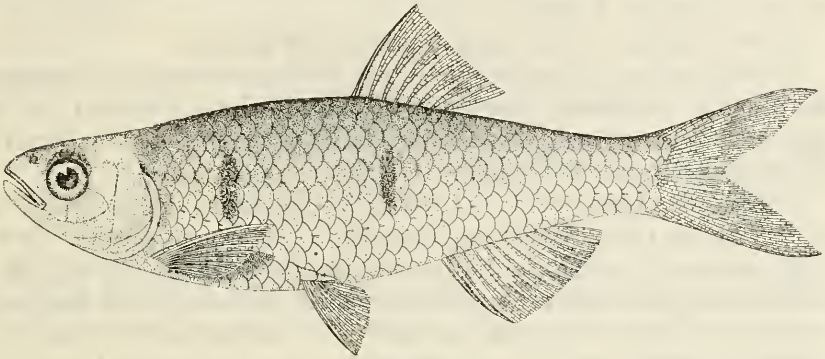


Figure 24.—*Barilius koratensis* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

BARILIUS ORNATUS Sauvage

Barilius ornatus Sauvage, 1883b, p. 153 (Menam Chao Phya).

Described from a specimen, 11 cm. long, collected in the Menam Chao Phya by Dr. Harmand, this species does not appear to have been met with again. The description is imperfect, and a number of features of diagnostic value are not referred to. There are no barbels, the body is comparatively deep (3 in length), the maxillary extends to a line drawn vertically from the pupil, the scales in the lateral line number 45, the origin of the dorsal fin is midway between the pupil and the base of the caudal, the origin of the anal fin is opposite the termination of the dorsal base, and the body is marked with 12 transverse steel-blue bands.

BARILIUS GUTTATUS (Day)

Opsarius guttatus Day, 1869, p. 620 (Burma).
Bola harmandi Sauvage, 1880, p. 231 (Cambodia); 1881, p. 188, pl. 6, fig. 6 (Cambodia).
Barilius harmandi Fowler, 1934a, p. 141, figs. 112, 113 (Chiengmai); 1935a, p. 130 (Sriracha); 1937, p. 212 (Mepoon).

Originally described from Burma, this species was added to the local fauna when specimens were collected in 1924 by Dr. Malcolm Smith from a hill stream near Raheng on the Meping in Central Thailand.

Through the courtesy of Dr. Sunder Lal Hora, of the Indian Museum in Calcutta, the writer was able to compare the Raheng fish with a specimen of *B. guttatus* from Prome, on the Irrawaddy in Burma, one of the lot from which Day described the species; the agreement was complete. Other waters from which the fish has been obtained are the Meklong at Tambol Na Muang, September 1, 1930; and the Meyuam at Mesarieng, January 23, 1933, the last in the Salwin drainage system. Additional specimens, in the Deignan collection, were obtained from the Salwin at Ta Fang, October 15, 1936, and from the Mekong at Chiengsen Kao, January 9, 1937.

In local waters it reaches a known length of 27.5 cm.

Under the name of *Barilius harmandi*, Fowler reported the fish from the Meping, the Metang, and the Mepoon in Northern Thailand; and a specimen in the British Museum thus labeled was collected by Vernay in the Mewang, near Lampang in the Central area.

There seems little doubt that *Bola harmandi* Sauvage, described in 1880 from the Grand Lakes in Cambodia, is the present species. Sauvage compared it with the Indian *Barilius bola*, which is a very dissimilar form, but made no comparison with *B. guttatus*, which Day had described in 1869. Sauvage's account is incomplete and in some respects at variance with his figure published a year later, the artist showing features that the author overlooked, such as the presence of a small but very distinct maxillary barbel, while the description definitely states there are no barbels. Fowler's description and figure of a specimen 26.5 cm. long from the Meping at Chiengmai indicated a fish very different in body coloration from Sauvage's account which, however, did not agree with his figure. Fowler (1934a) noted that in *B. harmandi* "the dark bar in the lower caudal lobe is usually an unfailing character of distinction," but the same dark bar is present in *B. guttatus.*

To indicate the similarity in the fish described under the names *B. guttatus* and *B. harmandi*, the following comparison has been prepared. The only difference worthy of note in the three sets of data is in the number of scales between the midline of the back and the lateral line; the fewer scales shown in Sauvage's figure would have some importance if this feature had been referred to in the text or if full reliance could be placed in the accuracy of the drawing.

This species may be recognized easily by its very large mouth, the maxillary extending far beyond a vertical from the posterior margin of the eye and being about two-thirds the length of the head. Combined with this feature is the presence of rows of dark spots on the side and the broad dark submarginal longitudinal band on the lower lobe of the caudal fin.

Character	*Barilius guttatus* after Day 17.5 cm.	*Barilius harmandi* after Sauvage 20 cm.	*Barilius harmandi* after Fowler 26.5 cm.
Depth in standard length	4.2*	4.33	4.6.*
Head in length	3.8*	3.75	3.5.*
Eye in head	4 to 5	5.5	8.*
Maxillary in head	1.6*	1.5*	1.5.*
Scales in lateral line	44 to 48	50 (48 in fig.)	48.*
Scales above lateral line	9.5*	7.5*	9.5.*
Scales below lateral line to base of ventral fin.	2	4*	3.5.*
Rostral barbels	None or rudimentary	None*	None.*
Maxillary barbels	None or rudimentary	Present*	None.*
Dorsal rays	ii, 7	iii, 7	iii, 7.
Anal rays	iii, 11	iii, 10	iii, 10.
Coloration	Silvery, with 1 or 2 rows of blue spots on side; a dark band on lower caudal lobe.	Silvery, without spots; a black band on lower caudal lobe.†	A row of dark spots on upper side and irregularly arranged dark spots below; a dark band on lower caudal lobe.

*Deduced from figure; not given in text.

†The figure of the type in Sauvage's 1881 paper shows an incomplete row of dark spots along side and some vague spots below; the inference is that the colors in the preserved specimen faded and were overlooked by Sauvage but were in part detected by the artist.

The barbels are subject to variation, but are usually absent. Day (1878, vol. 2) shows none in his figure but states that "a rudimentary rostral or maxillary pair may be present." In Thailand, if either pair is in evidence it is the maxillary.

Europeans and Americans, observing this silvery, dark-spotted fish in clear swift streams in Northern Thailand, have sometimes been misled into believing the fish to be a trout.

A vernacular name used on the Meklong is *pla nang ao*.

Genus CIRRHINUS Oken

Cirrhinus OKEN, Isis, 1817, p. 1182a. (Type, *Cyprinus cirrhosus* Bleeker.)

The cirrhinid fishes of Thailand form a fairly distinct group having a small but broad mouth, deficient or very thin lower lip, small postsymphyseal knob in lower jaw, triserial pharyngeal teeth, various development of barbels, dorsal fin arising in advance of ventrals and having 7 to 12 branched rays, the last simple ray nonosseous and nondenticulated, and branched anal rays numbering 5.

Four species have been listed as occurring locally and may be recognized as follows:

1*a*. A pair of maxillary barbels present; scales in lateral line 32 to 38; scales around caudal peduncle 20.
    2*a*. Maxillary barbels usually present, but often absent or so small as to be overlooked in postlabial groove; rostral barbels as described in type never seen in Siamese examples; coloration of body and fins plain____ jullieni

2b. Maxillary barbels one-fourth diameter of eye; body with 5 narrow, well-defined blackish longitudinal stripes following rows of scales of back and side; a dark elliptical spot on caudal peduncle; edge of dorsal fin black; interradial membranes of dorsal fin blackish medianly________ lineatus

1b. Barbels absent.

3a. Scales in lateral line 53 to 60; scales in transverse series 12–1–8 or 9; scales around caudal peduncle 28 or 30; ventral fins with no dark edge. microlepis

3b. Scales in lateral line 32 to 34; scales in transverse series 6–1–5; scales around caudal peduncle about 14; ventral fins with a sharply defined dark edge____ marginipinnis

CIRRHINUS JULLIENI Sauvage

Cirrhina jullieni Sauvage, 1878b, p. 237 (Cambodia, French Indo-China); 1881, p. 174, pl. 6, fig. 2 (Laos, French Indo-China).

Cirrhinus jullieni Fowler, 1934a, p. 115 (Bangkok, Chiengmai, Chiengsen); 1935a, p. 122, figs. 63, 64 (Bangkok); 1935b, p. 510 (Old Chiengsen); 1937, p. 173 (Bangkok, Mepoon, Pitsanulok, Kemarat).

Described in 1878 from the Mekong in Laos, this species has been found in various parts of Central, Northern, and Eastern Thailand, being especially common in tributaries of the upper Menam Chao Phya.

This fish reaches a length of 20 cm. A specimen 17.2 cm. long taken September 8, 1934, in a canal in front of the writer's residence in Bangkok, was a female with ripe eggs; the lateral-line scales were 34, the transverse scales to ventral base 5.5–1–4, the predorsal scales 10, and the circumpeduncular scales 20; there were no barbels; the lips were not fringed; the free edge of the dorsal rays was black and the interradial dorsal membranes had dark areas.

Apparently no specimens have been taken in local waters that agree fully with Sauvage's descriptions, which called for a pair of rostral barbels, fringed lips, and 4.5 or 5 rows of scales between the lateral line and the base of the ventral fin. In Thailand the species normally has a pair of short maxillary barbels, which are concealed in the postlabial grooves. Specimens are met with, however, in which the barbels are altogether absent or are represented by mere rudiments. The original description referred only to superior, that is, rostral barbels, shorter than the eye, but no barbels are shown in Sauvage's plate accompanying his 1881 report, and no rostral barbels have been found in Siamese specimens. A fringed margin of the lips is mentioned in Sauvage's supplementary account, but this seems a variable feature as it has not been observed in local specimens. A half-grown specimen of *Cirrhinus jullieni* in the British Museum from the Bangpakong examined by Dr. Ethelwynn Trewavas was ascertained to have no barbels and no fringes on the lips.

CIRRHINUS LINEATUS, new species

FIGURE 25

Description.—Depth 3.6 in standard length; depth of caudal peduncle 1.5 in its length and 2.5 in depth of body; head 4.3, its width 1.25 in its depth and 1.7 in its length; snout 3 in head; eye 4.5 in head, 1.5 in snout, and 2.5 in interorbital space; snout and top of head with numerous minute pores and low papillae; width of mouth somewhat greater than diameter of eye, lips thin and entire; a pair of maxillary barbels 0.25 length of eye concealed in postlabial groove.

Squamation: Scales (tube-bearing) in lateral line 33, in transverse series 5.5–1–3 to base of ventral, in predorsal region 10, surrounding caudal peduncle 20; ventral axillary scale 2.5 in length of fin.

Fins: Origin of dorsal fin far in advance of ventrals, over ninth scale of lateral line; dorsal rays iii, 8, first branched ray as long as head; caudal fin longer than head, equal to depth of body, deeply forked, lobes pointed; anal rays iii, 5, longest more than 0.5 head; ventral fins 1.2 in pectorals, which are slightly shorter than head, pectoral rays i, 13.

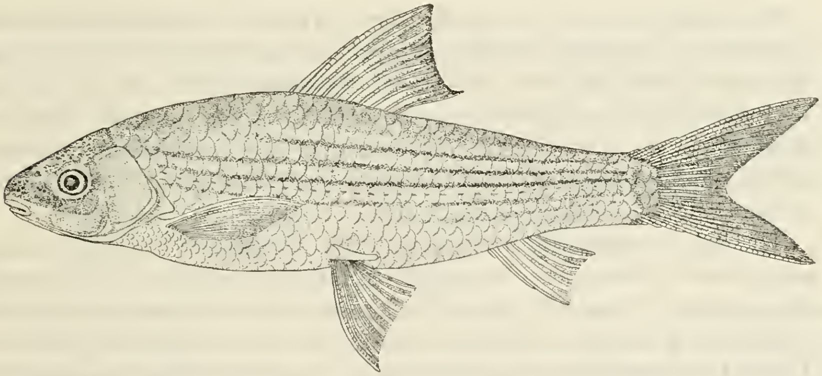


FIGURE 25.—*Cirrhinus lineatus*, new species: Type (U.S.N.M. No. 107960). Drawn by Mrs. Alice C. Mullen.

Coloration: Generally silvery white, back and top of head light olive; five narrow, sharply defined blackish longitudinal stripes on body, three above lateral line most distinct; a dark elliptical spot on caudal peduncle at base of caudal fin; edge of dorsal fin black, dorsal membranes medianly blackish in their posterior half; caudal fin dusky green; other fins pale greenish.

Type and paratype.—The type (U.S.N.M. No. 107960), a specimen 14.9 cm. long, was taken in Lam Ton Lang, a tributary of the Menam Sak, Central Thailand, July 19, 1925. U.S.N.M. No. 119484 is a paratype.

Other specimens.—This species is known from the type, the paratype, and a third specimen, 12.5 cm. long, in the Deignan collection, taken in the Mefang, tributary of the Mekok, July 12, 1936.

Remarks.—The species may fall within the limits of variation of the imperfectly described *C. jullieni* Sauvage, but in the absence of information thereon it seems best to describe the present form, which is characterized by short maxillary barbels, entire lips, scales of moderate size (with 20 surrounding the caudal peduncle), and sharply defined narrow blackish longitudinal stripes that are possessed by no other species, although in several species there are broken lines made up of dark spots at the bases of the scales.

CIRRHINUS MICROLEPIS Sauvage

Cirrhina microlepis SAUVAGE, 1878b, p. 236 (Mekong, Cambodia); 1881, p. 173, pl. 8, fig. 2 (Mekong); 1883b, p. 152 (Menam Chao Phya).—HORA, 1923b, p. 158 (Bangkok).—VIPULYA, 1923, p. 225 (Bangkok).

Cirrhina aurata SAUVAGE, 1878b, p. 236 (Mekong, Cambodia); 1881, pp. 163, 173 (Mekong).

Cirrhinus auratus FOWLER, 1935a, p. 122, figs. 61, 62 (Bangkok).

The small scales of this species serve to make its identification easy. There are up to 60 scales in the lateral line and 10 to 12 rows between the lateral line and the midline of the back before the dorsal fin. Described from the Mekong in Cambodia, the fish has been found to range throughout the Menam Chao Phya, and is especially common in the Bangkok region. One specimen from Chantabun was collected in the Bangkok market March 5, 1925.

The fish is essentially a vegetarian but it eats also insects, shrimps, and worms. It reaches a large size. Examples weighing 3 to 5 pounds are common. Prince Vipulya (1923) reports the taking of a fish of 8 pounds on a rod and one of 15 pounds in a net in the Bangkok area. Under the vernacular name of *pla nuan chan* this fish is recognized as one of the best of the local fresh-water food fishes. In Bangkok it is extensively grown in ponds and canals, and always meets with ready sale because of its attractive coloration and graceful lines as well as its food qualities.

Neither the original description of *Cirrhina aurata* by Sauvage nor any subsequent description seems to bring out any essential features separating that species from *C. microlepis.* The latter name has priority over *C. aurata* by being first on the page.

CIRRHINUS MARGINIPINNIS Fowler

Cirrhinus marginipinnis FOWLER, 1937, p. 173, figs. 108, 109 (Pitsanulok, Mepoon, Bangkok).

Described from very numerous specimens from the basin of the Menam Chao Phya, this species, according to Fowler, is "always distinguished from *Cirrhinus jullieni* by its ventrals terminally edged dark gray to dusky," also referred to as dark brown. There appear to be no other distinctive characters. The waters from which it is listed are occupied also by *C. jullieni;* and the presence of a narrow dark margin to the ventral fins may come within the limits of variation in the variable species *jullieni*. *C. marginipinnis* has no barbels, and Fowler reports specimens of *C. jullieni* without barbels.

The fish reaches a length of 17 cm.

Genus PUNTIUS Hamilton

Puntius HAMILTON, Fishes . . . River Ganges, p. 310, 1822. (Type, *Cyprinus puntio* Hamilton.)

The classification of the Old World fishes falling within the wide limits of the genus *Barbus* as proposed by Cuvier (1817), with *Cyprinus barbus* Linnaeus as its type, has been highly unsatisfactory to systematic workers. After the elimination of a dozen or more perfectly distinct genera that Günther, Day, and others placed in *Barbus*, there remains a large group whose exact relations and nomenclature await elucidation.

For the present purposes, it is convenient to adopt for a section of the Thailand barbs the generic name *Puntius*, first used by Hamilton in 1822 for a number of Indian species. Bleeker (1863 (301), vol. 3, p. 27) designated Hamilton's *P. sophore* as the type of *Puntius*, and proposed three subgenera, as follows, based on the number of barbels:

Barbodes, 4 barbels; type, *Barbodes belinka* Bleeker
Capoëta, 2 barbels; type, *Capoëta amphibia* Valenciennes
Puntius, no barbels; type not indicated

Bleeker's course does not appear to have been sound. The subgenus *Puntius* should have represented the genus in *sensu stricto;* that is, it should have agreed with the genotype in the special character (number of barbels) on which the genus was divided. Inasmuch as *sophore* has four barbels, the name *Puntius* was left without appropriate status; the fish called *Barbodes*, with four barbels, should properly have been designated *Puntius*.

Under the International Rules of Zoological Nomenclature, the type species of *Puntius*, in the absence of any indication or designation by its author, was automatically determined by tautonymy (Article 30, *Id*) and Hamilton's *puntio* must be considered the genotype; *Puntius puntio*, a small fish of Bengal and Burma, has no barbels.

The puntiid fishes are the most numerous as to species and among the most abundant as to individuals among the fresh-water fishes of Thailand. It is hardly an exaggeration to state that in any haul of a seine or trap in any part of the country these fishes are almost certain to be represented.

They exhibit a wide range in size, the smallest species being only an inch in length, the largest more than a foot. Regardless of size, they are eaten by the local people, and, on account of their general abundance and ease of capture, constitute an important element in the food supply.

While most of the species are plain silvery without distinguishing marks, some are brilliant golden, some are strikingly spotted or cross-banded, and some have beautiful red, blue, and other colors on head, body, and fins. In addition to the 31 species shown in the following key, there have been ascribed to Thailand a few others of invalid or doubtful status that are noted at the end of the regular series. Some of the local species are unfortunately known from sparse material, in some cases from single specimens, so that intraspecific variability cannot be determined.

1*a*. No barbels.
  2*a*. Last simple dorsal ray osseous and denticulated, much longer than head; last simple anal ray osseous and strong; scales in lateral line 37; scales in transverse series to base of ventral fin 7–1–4.5; body marked by oblique blackish bands; size medium __________ **bulu**
  2*b*. Last simple dorsal ray nonosseous and nondenticulated, much shorter than head; last simple anal ray nonosseous and weak; scales in lateral line 22 to 25; scales in transverse series to base of ventral fin 4 or 5–1–3; a round or vertically elongate spot at third scale of lateral line, another such spot on caudal peduncle at posterior end of anal base; size small __________ **stoliczkae**
1*b*. Two barbels (maxillary).
  3*a*. Last simple dorsal ray nonosseous and smooth; lateral line incomplete; only first 6 scales bearing tubules; scales around caudal peduncle 12; a black spot on caudal peduncle, another black spot on basal part of dorsal fin __________ **masyai**
  3*b*. Last simple dorsal ray osseous and smooth; lateral line complete; scales in lateral line 23 to 26.
    4*a*. No black spot on dorsal fin; a black spot on caudal peduncle; scales around caudal peduncle 12, 14, or 16 __________ **leiacanthus**
    4*b*. Usually a black spot on basal part of soft dorsal rays and a black spot on caudal peduncle.
      5*a*. A dark median band and a dark margin on dorsal fin; a narrow dark longitudinal stripe on body; scales around caudal peduncle 12. **spilopterus**
      5*b*. No dark median band and no dark margin on dorsal fin; no dark longitudinal stripe on body; scales around caudal peduncle 16. **sophoroides**
  3*c*. Last simple dorsal ray osseous and denticulated; lateral line complete or incomplete.
    6*a*. Lateral line incomplete; body deep (depth 2.12 to 2.2); maxillary barbel about 0.5 eye; head and body marked by 5 black cross bands. **partipentazona**
    6*b*. Lateral line complete; depth 2.3; maxillary shorter than eye; no dark spots on dorsal fin; sides without bars or spots; base of dorsal and anal with a few scales; dorsal fin origin over ninth scale of lateral line, midway between tip of snout and base of caudal fin ______ **viehoeveri**

6*c*. Lateral line complete; body more elongate (depth 2.6 to 3.2); maxillary about equal to or shorter than eye; body marked by a longitudinal row of dark spots; a dark spot on back at base of dorsal fin anteriorly.

7*a*. Dorsal fin origin over eighth scale of lateral line; a small black spot on body above base of anal fin.

8*a*. Origin of dorsal fin much nearer to tip of snout than to base of caudal fin; branched dorsal rays 8; depth of body 3.2 in standard length; depth of caudal peduncle 1.5 in its length; 4 roundish black spots on side of which 3 anterior are above lateral line, 1 on caudal peduncle on each side of lateral line---- stigmatosomus

8*b*. Origin of dorsal fin midway between tip of snout and base of caudal fin; branched dorsal rays 7; depth of body 2.8 in standard length; depth of caudal peduncle equal to its length; 4 black vertical bands on body all extending below lateral line; a round black spot on caudal peduncle on each side of lateral line; a black spot on back under posterior dorsal rays-------------------- sametensis

7*b*. Dorsal fin origin over tenth scale of lateral line, midway between tip of snout and base of caudal fin; 6 vertically elongated black or dark brown spots on side above lateral line---------------- pessuliferus

1*c*. Four barbels (rostral and maxillary).

9*a*. Last simple dorsal ray osseous, nondenticulated.

10*a*. Scales in lateral line 22; scales in transverse series above lateral line 3.5; predorsal scales 7; circumpeduncular scales 12; mouth moderate, maxillary extending opposite anterior margin of eye; barbels shorter than eye; dorsal fin well forward, its origin over sixth scale of lateral line, nearer to tip of snout than to base of caudal fin; dorsal and caudal fins plain------------------------------------ paucisquamatus

10*b*. Scales in lateral line 29 to 33; scales in transverse series above lateral line 4.5 or 5.5; predorsal scales 9 to 12; circumpeduncular scales 14.

11*a*. Scales in lateral line 29; scales in transverse series above lateral line 4.5; predorsal scales 9 or 10; mouth moderate, maxillary extending opposite anterior margin of eye; barbels shorter than eye; dorsal fin well forward, its origin over seventh scale of lateral line, midway between tip of snout and posterior base of anal fin; dorsal and caudal lobes black-tipped-------------------------------- colemani

11*b*. Scales in lateral line 33; scales in transverse series above lateral line 5.5; predorsal scales 12; mouth small, maxillary extending opposite nostrils; barbels equal to eye; dorsal fin well backward, its origin over tenth scale of lateral line midway between tip of snout and base of caudal fin; dorsal rays and membranes blackish distally; caudal fin with posterior edge dusky---------------------- faucis

9*b*. Last simple dorsal ray osseous, denticulated.

12*a*. Always 28 or fewer scales in lateral line (including all tube-bearing scales); anal rays iii, 5.

13*a*. Scales in lateral line 23 or 24; predorsal scales 8; scales around caudal peduncle 12.

14*a*. Scales in transverse series from midline of back to base of ventral fin 5.5–1–2 or 2.5; last simple dorsal ray with 8 coarse serratures; coloration plain -------------------------------------- wetmorei

14*b*. Scales in transverse series from midline of back to base of ventral fin 4.5–1–2 or 2.5; last simple dorsal ray with numerous fine serratures; body marked by 2 black cross bands anteriorly, and 1 black longitudinal band posteriorly-------------- lateristriga

13*b*. Scales in lateral line 23 to 28; scales in transverse series to base of ventral fin 4.5 or 5–1–2.5 or 3; predorsal scales 8 to 10.

15*a*. Scales around caudal peduncle 14; rostral barbels about equal to eye, maxillary barbels somewhat longer; coloration golden, each scale of back with a dark brown base; ventral fins orange; pectoral fins bright yellow---------------------------- **daruphani**

15*b*. Scales around caudal peduncle 12; rostral barbels longer than eye; maxillary barbels twice diameter of eye or less; coloration silvery, body with a black spot on back at base of dorsal fin, a black spot on caudal peduncle, young otherwise spotted--------- **binotatus**

15*c*. Scales around caudal peduncle 12; rostral barbels slightly shorter than maxillary, which are equal to or longer than eye.

16*a*. Caudal lobes much longer than head; lateral line with tubules deficient on a few anterior scales; length of caudal peduncle 1.16 to 1.5 times its depth; scales of back with dark brown edges forming a network------------------------------------ **vernayi**

16*b*. Caudal lobes equal to head; lateral line with tubules on all scales; length of caudal peduncle equal to its depth; scales of back with dark brown basal pockets-------------------------- **beasleyi**

12*b*. About 29 to 33 scales in lateral line; scales between midline of back and lateral line 4.5 to 6.5.

17*a*. Anal rays iii, 5 (exceptionally iii, 6 or iii, 7); barbels well developed.

18*a*. Scales around caudal peduncle 12; scales in transverse series to base of ventral fin 6–1–3; predorsal scales 12; a large black spot on dorsal fin-- **foxi**

18*b*. Scales around caudal peduncle 14; scales in transverse series to base of ventral fin 5.5–1–2.5 or 3; predorsal scales 10 to 12; lateral line complete, incomplete, or absent; coloration plain----- **huguenini**

18*c*. Scales around caudal peduncle 16.

19*a*. Scales above lateral line 4.5; scales between lateral line and base of ventral fin 3 or 3.5; predorsal scales 10 or 11; snout short, 1.3 in eye; maxillary extending under anterior edge of eye; maxillary barbel 0.8 eye; caudal fin longer than head; a jet black spade-shaped spot on caudal peduncle; a blackish stripe from upper end of gill opening to base of caudal fin------ **simus**

19*b*. Scales above lateral line 5.5 to 6.5; scales between lateral line and base of ventral fin 3.5 to 4.5; predorsal scales 10 to 13; no black spot on caudal peduncle; no black stripe from upper end of gill opening to base of caudal fin.

20*a*. Eyes nearer to dorsal profile than to ventral profile of head.

21*a*. Snout shorter than eye; serrations on last simple dorsal ray about 20; all fins red--------------------------- **bramoides**

21*b*. Snout longer than eye; serrations on last simple dorsal ray 12 to 15; fins whitish, each caudal lobe may have a black horizontal edge---------------------------------- **sarana**

20*b*. Eyes nearer to ventral profile than to dorsal profile of head; snout shorter than eye; serrations on last simple dorsal ray 12-- **jolamarki**

17*b*. Anal rays iii, 6; barbels minute or rudimentary, coloration silvery. **gonionotus**

12*c*. About 32 to 38 scales in lateral line; anal rays iii, 5.

22*a*. Scales between midline of back and lateral line 8 or 9.

23*a*. Scales in lateral line 32; predorsal scales 9; depth 1.8 to 2.12 in standard length; maxillary barbel equal to or shorter than eye;

last simple dorsal ray with coarse serratures (5 to 12); a black blotch on apex of dorsal fin; caudal lobes plain__________ altus

23*b*. Scales in lateral line 35 or 36; predorsal scales 13; depth 2.3 to 2.5 in standard length; maxillary barbel longer than eye; last simple dorsal ray with fine serratures (15 to 20); a black blotch on apex of dorsal fin; a broad black submarginal band on each caudal lobe__________ schwanenfeldii

22*b*. Scales between midline of back and lateral line 5 or 5.5; predorsal scales 10 or 11.

24*a*. Depth of body 3.4 to 3.75 in standard length; barbels less than 0.3 diameter of eye; about 8 serratures on last simple dorsal ray; a black spot on outer half of dorsal fin__________ ashmeadi

24*b*. Depth of body 2.5 to 3 in standard length; barbels equal to or longer than diameter of eye; about 30 serratures on last simple dorsal ray; a broad black marginal horizontal band on each caudal lobe__________ orphoides

1*d*. Status uncertain__ bocourti, laoensis, balleroides, siamensis, pinnauratus

PUNTIUS BULU (Bleeker)

Systomus bulu Bleeker, 1851 (45), p. 207 (Bandjermassing, Borneo).

Puntius (*Puntius*) *bulu* Bleeker, 1863 (301), vol. 3, p. 110 (Siam); 1865 (356), p. 176 (Siam).

Barbus (*Puntius*) *bulu* Hora, 1924a, p. 470 (Tale Sap).

Puntius bulu Koumans, 1937a, p. 62 (Tale Sap).

Bleeker wrote in 1863: "The bulu-bulu inhabits not only the large rivers of Sumatra and Borneo, but also those of Siam, where M. the Count of Castelnau found it during his visit to Bangkok." This statement was apparently partly incorrect as regards Thailand. The fish is not known from the large rivers but seems to be peculiar to lakes in Peninsular Thailand, that is, in the inner part of the Tale Sap and in the Tale Noi, and in the small, short streams connected therewith.

The recent finding of this species in Perak by Herre and Myers (1937) is interesting and, taken in conjunction with other records by these authors, suggests that the assumed disconnected distribution of various fresh-water fishes that have heretofore been known from Borneo and Sumatra on the one hand and Central Thailand on the other may disappear when more intensive collecting shall have been done in the Malay Peninsula.

The full-grown fish are strikingly marked with oblique black cross bands shown in Bleeker's plate in the Atlas but not referred to in the description by Weber and de Beaufort.

This is one of the common fishes of the Tale Noi, where a special form of gill net is set for it and examples up to 25 or 30 cm. long are taken.

The local fishermen and those of the Tale Sap have a special name for it—*pla tum*.

PUNTIUS STOLICZKAE (Day)

Danio stoliczkae DAY, 1869, p. 621 (Burma).

This is a small species heretofore known only from Burma. Its status as a Thai fish rests on a specimen taken by the writer in the Meyuam at Mesarieng, Western Thailand, January 23, 1933; on 25 specimens from the Mechem, a tributary of the Meping, Northern area, taken by A. R. Buchanan of Chiengmai in October 1935, and forwarded to the U. S. National Museum by H. G. Deignan; and five specimens from the Salwin at Ta Fang, Western district, collected by Deignan October 14, 1936.

In Burma this species is credited with a length of 10 cm. The maximum length of the Thai specimens in hand is 5.5 cm. in a male from the Salwin. Two females, 4.2 and 4.8 cm. long, from the same river contain well-developed eggs. In the smallest specimens, 1.9 to 2.5 or 3 cm. long, the spot on the caudal peduncle shows a tendency to extend toward the upper median line, and in some the spots of the two sides almost meet.

Through the courtesy of the Indian Museum in Calcutta, the U. S. National Museum has received a specimen of *Puntius stoliczkae* from Sandoway, Lower Burma; this specimen is one of a lot referred to in a paper by Dr. Sunder Lal Hora (1937f). The figure given by Hora is a great improvement over the one in Day's Fishes of India. The Thai specimens agree with the Burmese example, exhibiting such differences as represent individual variation in squamation and in size and denticulation of the last simple dorsal ray. There is a short vertical black blotch on the lateral line involving the third and fourth scales, together with several scales above and below, and there is a round black spot about the size of the eye on the lateral line just posterior to the base of the anal fin; the dorsal fin has a narrow black edge and irregular black spots on the basal two-thirds of the rays and membranes.

Puntius stoliczkae is very similar to *P. ticto* Hamilton from India and may prove to be identical. The supposed differences may disappear when sufficient material is available for study. Day distinguished *stoliczkae* from *P. ticto* by its possession of a lateral line complete instead of more or less incomplete, and 9 instead of 11 predorsal scales. Hora (1937f, p. 330) has shown, however, that in *P. stoliczkae* the lateral line is variable, and may be complete or limited to as few as 7 scales. Hora says "the most important difference between the two species, however, lies in the number of the predorsal scales—8 to 9 in *B. stoliczkae* and 11 in *B. ticto*," but Thai specimens have the predorsal scales numbering 8, 9, or 10, with 8 the predominant number.

PUNTIUS MASYAI, new species

FIGURE 26

Description.—Moderately elongate, strongly compressed, depth of body 2.8 in standard length, depth of caudal peduncle slightly less than its length and 2.5 in head; length of head equal to depth of body; eye about equal to snout, 3.5 in head and less than the flat interorbital space; mouth terminal, strongly arched, maxillary extending to a point under anterior edge of eye; a pair of maxillary barbels 0.25 diameter of eye.

Squamation: scales of lateral line 26, of which only the anterior 6 are tube-bearing; scales in transverse series from midline of back before dorsal fin to base of ventral 9.5; predorsal scales 9; circumpeduncular scales 12.

Fins: Dorsal fin emarginate, its origin over origin of ventrals, much nearer to base of caudal than to end of snout, dorsal rays iii, 8, last simple ray nonosseous, without serratures, 0.75 length of head; caudal fin about length of head, deeply forked, lobes sharply pointed; anal emarginate, rays iii, 5, longest simple ray about 0.5 head; ventral fins extending on anal base, 1.5 in head, a small axillary scale; pectoral rays i, 12, longest about length of ventrals and reaching to ventral origin.

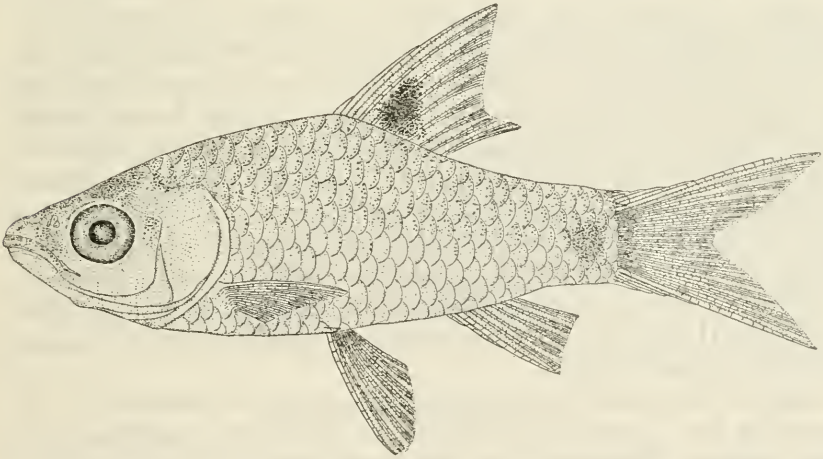


FIGURE 26.—*Puntius masyai*, new species. Type (U.S.N.M. No. 107954). Drawn by Mrs. Alice C. Mullen.

Coloration: Silvery; a diffuse brownish area on shoulder; a round black spot, smaller than eye, on middle of caudal peduncle; a sharply defined ovate jet-black spot on basal part of anterior branched dorsal rays; fins otherwise hyaline.

Type and paratype.—The type (U.S.N.M. No. 107954) is 2.5 cm. long, taken July 12, 1928, in a mountain brook at Ban Ang on Kao Sabap, Southeastern Thailand. The paratype and only other specimen (U.S.N.M. No. 107955) is of the same size and was obtained at the same time and place.

Remarks.—A diminutive species, known only from a small brook on Kao Sabap. It is easily distinguishable by its single pair of barbels, nonosseous last simple dorsal ray, and incomplete lateral line, only the first 6 scales having tubules, together with the conspicuous black spot on the caudal peduncle and the large, very sharply defined black spot on the dorsal fin. It is the only local species of *Puntius* except *P. partipentazona* having an incomplete lateral line.

The species is named for Luang Masya Chitrakarn, of the Siamese Bureau of Fisheries, whose activities have added much to the knowledge of the fresh-water fishes of Thailand.

PUNTIUS LEIACANTHUS (Bleeker)

Systomus (*Capoëta*) *leiacanthus* Bleeker, 1860 (265a), p. 356 (Java).

Barbus brevis von Martens, 1876, p. 402 (nomen nudum) (Petchaburi).—Fowler, 1934b, p. 346 (Ban Thung Luang); 1937, p. 198, figs. 165, 166 (Tachin, Bangkok, Rayong).

Puntius leiacanthus Sauvage, 1881, p. 163 ("Petschaburi, en Siam"); 1883b, p. 153 (Menam Chao Phya).

Puntius brevis Weber and de Beaufort, 1916, vol. 3, p. 176 (Siam).—Koumans, 1937a, p. 64, fig. 2 (Peninsular Siam).—Fowler, 1939, p. 41 (Huey Yang).

Barbus (*Puntius*) *brevis* Hora, 1923b, p. 156 (Bangkok).

Outside of Java, from which island the species was described by Bleeker in 1850, this fish seems to be known only from Thailand, where it is widely distributed. It has been collected in the Patani River, the Tale Sap, and the Tale Noi in the Peninsula; from the Lower Menam Chao Phya, the Nakon Nayok, and the Tachin in Central Thailand; from the Meping in the Northern area; from tributaries of the Menam Mun in Eastern region; and from several localities in the Southeastern district, including the Chantabun River and a mountain brook on Kao Sabap. In some places and at certain times it may be very abundant.

Fish with fully ripe ovaries taken in the Patani River in October were 8.5 to 11 cm. long. The maximum length recorded from Thailand is between 11 and 12 cm.

Some of the normal characters of this species are indicated in the preceding key. There is a single pair of (maxillary) barbels shorter than the eye. The lateral-line scales number 23 to 26, the scales in transverse series to the base of the ventral fin 4.5 or 5–1–2.5 to 4, the predorsal scales 9, and the scales around the narrowest part of the caudal peduncle 12. The last simple dorsal ray is osseous but nondenticulated. There is a well-defined round black spot, smaller than eye, about the middle of the caudal peduncle.

The description of the species by Weber and de Beaufort indicates no variation in the scales surrounding the narrowest part of the caudal peduncle which are stated to number 12. However, Thailand examples otherwise indistinguishable from typical *P. leiacanthus* may have 12, 14, or 16 circumpeduncular scales, the predominant number being 16.

The following record of specimens of *P. leiacanthus* in the U. S. National Museum will illustrate the variation in this character:

Locality	Number of specimens	Number of scales around caudal peduncle
Patani River, Peninsular Thailand	2	Both with 12 scales.
Tale Sap, Peninsular Thailand	4	3 with 12 scales, 1 with 14 scales.
Chao Phya River, Central Thailand	7	All with 16 scales.
Nakon Nayok River, Central Thailand	1	16 scales.
Meping River, Northern Thailand	3	1 with 12 scales, 1 with 14 scales, 1 with 16 scales.
Chantabun River, Southeastern Thailand	3	All with 16 scales
Mun River, Eastern Thailand	3	All with 16 scales.
Klong Ban Taeng, Krat, Southeastern Thailand	4	All with 16 scales.

Bleeker separated *P. leiacanthus* from *P. brevis* chiefly on color, the former having a small, well-defined round black spot on the caudal peduncle, the latter having no such spot but a silvery band along the side from the head to the caudal fin. The black caudal spot has been found in all Thai examples, although apparently lacking in some Javanese material; the silvery longitudinal band has been met with in no Thai specimens.

It may be questioned whether the single specimen from Ban Thung Luang that Fowler recorded as *Barbus brevis* really represents that species; furthermore, Fowler's figures (1937) of a fish 11 cm. long from Bangkok do not seem to agree with the usual conception of this species; the body is deeper, the back is more elevated, the origin of the dorsal fin is more posterior, there are 29 tubule-bearing scales in the lateral line, and there are more predorsal scales than are supposed to occur in this form; and the dark stripe extending obliquely forward from the pupil across the cheek, as represented in the drawing, is otherwise unrecorded for this species. It is not doubted that Fowler had many specimens of *P. leiacanthus*, but his figures seem to indicate something else.

PUNTIUS SPILOPTERUS (Fowler)

Barbus spilopterus FOWLER, 1934a, p. 122, fig. 78 (Chiengmai); 1937, p. 188 (Tachin).

Known from three small specimens from Chiengmai, Northern Thailand, presumably from the Meping, and from numerous specimens from Tachin, Central Thailand.

The type is 3.6 cm. long.

The only differences from *P. leiacanthus*, as pointed out by Fowler, appear to be the markings on the dorsal fin (a round black spot on the basal part of the anterior rays, a dark median band, and a narrow dark gray margin in *P. spilopterus*, while in *P. leiacanthus* the fin is plain).

and the presence of a narrow dark stripe extending forward from the peduncular spot nearly to the head, as brought out in Fowler's figure, which has not been met with in any specimens of *P. leiacanthus*. This feature, together with obscure markings on the dorsal fin, leads to the identification as *P. spilopterus* of six specimens, the largest 6.7 cm. long, taken by Deignan in a pond in Chiengmai, April 1935.

PUNTIUS SOPHOROIDES (Günther)

Barbus sophoroides GÜNTHER, 1868, vol. 7, p. 144 (Bengal).

Three specimens in the British Museum, presented by the Siamese Museum and attributed to the Menam Chao Phya, are listed under the name *Barbus sophoroides* Günther, described from Bengal and Assam. Günther wrote (1868, vol. 7, 144): "This species, though very closely allied to *B. sophore*, appears to be distinct, not only on account of the presence of barbels, but of the smaller size of the scales." The question of the relationship of *P. sophoroides* and *Barbus sophore* (the latter attributable to Hamilton, 1822) is complicated by the fact that whereas in the original description of *B. sophore* the presence of four minute barbels is noted, Hamilton's figure shows none. This led Day (1878) to conclude that Hamilton had confused *B. sophore* with Day's *B. stigma*, the latter having no barbels.

A reexamination of the types of *sophoroides* and a comparison therewith of the Thai specimens so identified have been courteously made by Dr. Ethelwynn Trewavas, of the British Museum, who writes:

> All our specimens labelled *B. sophore* correspond to Day's *B. stigma*. I have examined a number of them, including some named *B. stigma* by Day, and none has the least trace of a barbel. They all have the coloration described and figured by Hamilton, and I have counted in several 22–24 scales in the lateral line, 4½ above and 4½ below it, 12 (one specimen 14) around the caudal peduncle. The types of *B. sophoroides* (61 and 48 mm. st. l.) have smaller scales, but have lost too many to make a count possible, except around the caudal peduncle, where there are 16. There is only one pair of barbels, less than ½ diameter of eye. The blotch on the dorsal fin is on the first three or four soft rays (in Day's *B. stigma* and in all our "*B. sophore*" on the third to sixth soft ray). The three specimens from the Menam R. agree perfectly with the types; scales 24–26 $\frac{5\frac{1}{2}}{4\frac{1}{2}}$, around caudal peduncle 16; a single pair of barbels less than ½ diameter of eye; dorsal spot as in types (2) or absent (1). The specimen without the dorsal blotch also has none on the caudal peduncle. One of the types has the caudal blotch, the other has not. The fish that Day took to be the true *B. sophore* is certainly very much like these. The chief difference is in the number and length of the barbels. He gives 3½ scales above the lateral line but figures more.
>
> These are the facts and I must leave the conclusion to you. Personally I think Günther's interpretation of *B. sophore*, agreeing as it does with the bulk of Hamilton's description and perfectly with his figure, has at least as much justification as Day's, and as Günther's *B. sophoroides* does not agree perfectly with Day's "*B. sophore*" I should retain *B. sophoroides* and give that name also to the Siamese specimens.

PUNTIUS PARTIPENTAZONA (Fowler)

Puntius sumatranus Weber and de Beaufort, 1916, vol. 3, p. 191 (Siam).
Barbus (*Puntius*) *sumatranus* Hora, 1924a, 470 (Tale Sap).
Barbus partipentazona Fowler, 1934b, p. 344, fig. 8 (Krat).

A most attractive little fish that formerly was confused with *P. sumatranus* Bleeker. Described from Southeastern Thailand, it is known also from Central and Peninsular regions and Malaya. The type, credited by Fowler to "Kratt," really came from the Krat River at Kao Seming. The fish is abundant in various brooks on Kao Sabap, up to 600 meters elevation, and numerous specimens were collected there in January, July, November, and December. In addition to the record for the inner lake of the Tale Sap given by Hora, the Siamese Bureau of Fisheries obtained the fish there in 1927. Farther north in the Peninsula, the present writer in 1928 collected specimens in Klong Nakon Noi, in the town of Nakon Sritamarat. The range of the fish in Thailand was further extended in 1934 when numerous specimens were collected in Bung Borapet, Central Thailand. The British Museum has specimens, presented by the Siamese Museum, from Krabin, a town on the upper Bangpakong River in Central Thailand.

A length in excess of 4.5 cm. has not been found in this country. The type was of that size. Most of the specimens measured have been 3 to 3.7 cm. long.

For small aquaria this fish is hardy and most attractive. In Bangkok it thrived on mosquito larvae and Entomostraca.

Duncker (1904, p. 180) recorded this fish from Negri Sembilan, one of the Malay States, and figured and described it briefly as *Barbus sumatranus* var.

In Southeastern Thailand, where this little fish is well known to the local mountain people, it is called *pla kang lai* (stripe-sided fish) and *pla sua* (tigerfish); the former name is applied also in Tale Sap.

PUNTIUS VIEHOEVERI Fowler

Puntius viehoeveri Fowler, 1943, p. 26 (Bangkok).

[This species was described after Dr. Smith's death. It is known only from the original description.

No data on its local vernacular name are available.—L. P. S.]

PUNTIUS STIGMATOSOMUS H. M. Smith

Figure 27

Puntius stigmatosomus Smith, 1931a, p. 13, fig. 6 (Kao Sabap).

This is a small species known from six specimens taken in April and December 1927 from Pliew stream on Kao Sabap, near Chantabun, in Southeastern Thailand, by Luang Masya Chitrakarn, of the Siamese Bureau of Fisheries. The largest specimens are 5.5 cm. long. The species is characterized by a pair of maxillary barbels, 26 scales in the lateral line, ossified and serrated last simple dorsal ray, origin of the dorsal fin over the eighth scale of the lateral line and much nearer to tip of snout than to base of caudal fin, and four rounded black spots along the side of the body, the first near the head, the last on the caudal peduncle, together with a small black spot on the back under the anterior dorsal rays and a small black spot above the base of the anal rays.

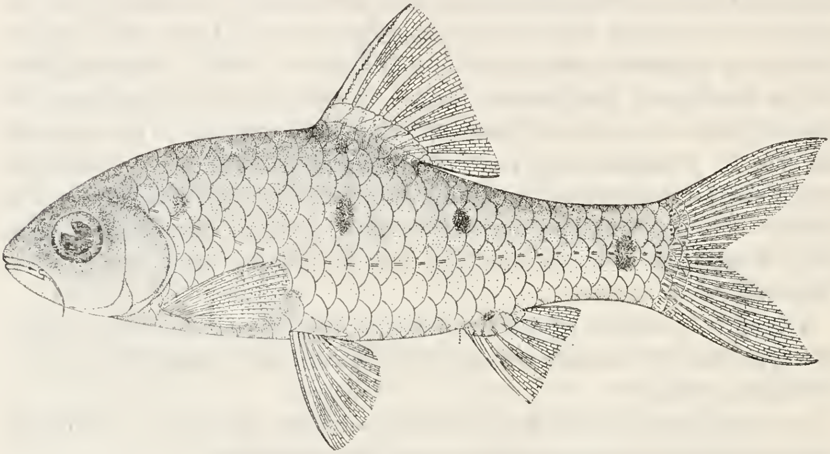


Figure 27.—*Puntius stigmatosomus* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

This species is close to *Puntius binotatus*, differing in the absence of rostral barbels and in several other features.

PUNTIUS SAMETENSIS, new species

Figure 28

Description.—Body and head strongly compressed; dorsal and ventral profiles similar; depth 2.8 in standard length; length of caudal peduncle equal to its depth, 1.5 in head; head 3.6 in length; eye 2.5 in head, 1.5 times snout and interorbital space; mouth terminal, strongly arched, lips thin, maxillary not extending to vertical from anterior edge of eye; a pair of maxillary barbels 0.6 eye.

Squamation: Lateral line complete, slightly decurved; scales in lateral line 24, in transverse line from middle of back to base of ventrals 4.5–1–2.5, in predorsal region 9, circumpeduncular 12; a scaly sheath to dorsal and anal fins.

Fins: Origin of dorsal fin about midway between tip of snout and base of caudal fin, over eighth scale of lateral line and over origin of ventrals; dorsal rays iii, 7, last simple ray osseous and bearing about 12 fine denticulations on its posterior edge, longest branched ray slightly shorter than head; caudal fin longer than head, deeply forked, lobes pointed; anal rays ii, 5, longest about 0.5 head; ventral rays i, 7, reaching origin of anal fin, 1.3 in head; pectoral rays i, 9, as long as ventrals but not reaching ventral origin.

Coloration: Silvery; a narrow blackish cross band on body halfway between eye and dorsal fin, the band extending below the lateral line and nearly meeting its fellow on opposite side across back; a second similar band under origin of dorsal fin; a third shorter, double blackish band extending under posterior end of base of dorsal fin below lateral line; a fourth blackish band over posterior end of anal fin, still shorter and reaching below lateral line; a round black spot on caudal peduncle on each side of lateral line; a round blackish spot on each side of the dorsal fin anteriorly, partly on the fin and partly on the scaly base; a less distinct blackish spot at the base of the last 2 or 3 dorsal rays; a round blackish spot on side immediately above the anterior base of the anal fin; fins otherwise hyaline.

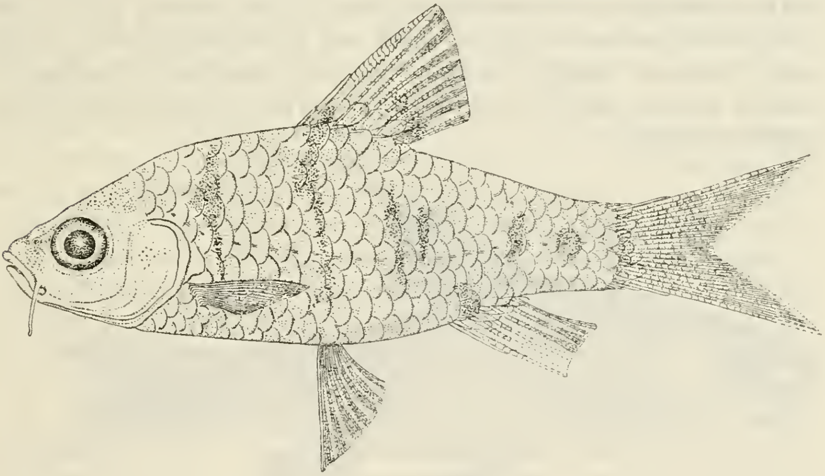


Figure 28.—*Puntius sametensis*, new species: Type (U.S.N.M. No. 117755). Drawn by Mrs. Alice C. Mullen.

Type.—A specimen (U.S.N.M. No. 117755), 3.3 cm. long, collected July 19, 1928, in Nong Samet, a small lake in Southeastern Thailand near Chantabun.

Remarks.—This species belongs in the group of small puntiid fishes, peculiar to Thailand, characterized by a single pair of barbels, a complete lateral line, large scales, and an osseous, denticulated simple dorsal ray, with the body marked by a single lengthwise row of dark spots or by a few dark narrow cross bands. The other members of the group are *P. stigmatosomus* and *P. pessuliferus*, which may be distinguished from the present species by the features indicated in the key.

PUNTIUS PESSULIFERUS (Fowler)

Barbus pessuliferus Fowler, 1937, p. 196, figs. 157, 158 (Kemarat).

This fish, described from numerous specimens 3.4 to 5.4 cm. long from the Mekong at Kemarat, is distinguishable by the single pair of long barbels, relatively few scales (23 or 24) in the lateral line, ossified and denticulated last simple dorsal ray, and a series of six or seven short blackish vertical bars on the side above the lateral line, with a round black spot on the back near the base of the dorsal fin anteriorly.

PUNTIUS PAUCISQUAMATUS, new species

Figure 29

Description.—Body and head very strongly compressed; depth of body 3 to 3.25 in standard length; least depth of caudal peduncle 2 in head and 1.75 in its own length; head 3.5 in standard length; eye 3 to 3.25 in head and equal to snout and interorbital space; mouth nearly terminal, strongly arched, lips thin, maxillary extending to opposite anterior edge of eye; maxillary barbel 0.8 eye, rostral barbel somewhat shorter.

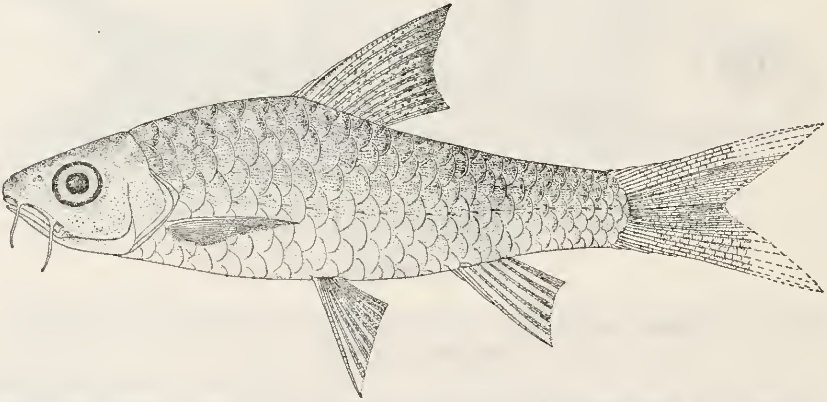


Figure 29.—*Puntius paucisquamatus*, new species: Type (U.S.N.M. No. 119713). Drawn by Mrs. Alice C. Mullen.

Squamation: Lateral line complete, scales in lengthwise series 22, in transverse series from midline of back to lateral line 3.5 and from lateral line to base of ventral fin 2, in predorsal region 7; circumpeduncular 12, all scales on back and side with conspicuous longitudinal parallel ridges numbering 12 to 16.

Fins: Dorsal fin arising over sixth scale of lateral line, nearer to tip of snout than to base of caudal fin; dorsal rays iii, 9, last simple ray osseous, slender, nondenticulated, its length less than head; caudal fin longer than head, forked for 0.5 its length; anal rays iii, 5; ventrals arising under seventh scale of lateral line, reaching anal opening, 0.5 length of head, rays i, 8; pectorals extending to base of ventrals, 0.75 length of head, rays i, 14.

Coloration: Silvery; scales of back and side with a dark basal crescent; body otherwise plain; fins hyaline.

Type and paratypes.—The type (U.S.N.M. No. 119713) 5.5 cm. long, and 3 paratypes (Nos. 119501, 119502) 4.5 to 5.3 cm. long, were collected on July 20, 1928, on Kao Luang, Nakon Sritamarat.

Remarks.—This little fish has been met with only in a brook near the base of the lofty Kao Luang, at a point about 1,000 feet above sea level, and in the gorge of the Mechem, in Northern Thailand. From the later locality a single specimen, 5.1 cm. long, was obtained by A. R. Buchanan and P. D. Harrisson in July 1935.

The fish is easily recognizable by the possession of only 22 tubule-bearing scales in the lateral line and only 6.5 scales in transverse series to the base of the ventral fin, with 7 predorsal and 12 circumpeduncular scales, in combination with two pairs of well-developed barbels and an osseous but nondenticulated last simple dorsal ray.

Among local species *P. colemani* (Fowler), from Mepoon, in Central Thailand, is the closest relative. In that species the scales with lateral-line-bearing tubules number 29, the scales in cross series number 9, and the predorsal scales number 9; and the tips of the dorsal and caudal lobes are sharply defined in black. Among species known from surrounding countries, the closest resemblance seems to be found in *P. stracheyi* (Day), described from Burma, in which the lateral-line scales are given as 23 although Day's figure shows 25, the dorsal fin has 9 branched rays, the barbels are longer than the diameter of the eye (the maxillary about twice the eye diameter), the body and head are larger, and the eye is smaller (5 in length of head, 1.5 in snout, and 2.5 in interorbital space); some of these differences, however, might be due to age, and a comparison of specimens of *P. stracheyi* and *P. paucisquamatus* of similar size is desirable in order to establish the validity of the latter.

PUNTIUS COLEMANI (Fowler)

Barbus colemani FOWLER, 1937, p. 197, figs. 159, 160 (Mepoon).

The type and only specimen known to the describer was 8 cm. long, from the Mepoon, Central Thailand, with 2 pairs of barbels, shorter than eye, 29 scales in the lateral line, last simple dorsal ray osseous and nondenticulated, and tips of dorsal fin and caudal lobes black. A single specimen, 5.2 cm. long, in the Deignan collection was taken in the gorge of the Mechem by A. R. Buchanan and P. D. Harrisson in July 1935. Differences from the type are explainable by difference in size; lateral line scales 29, scales in transverse series to base of ventral fin 5.5–1–2.5 or 3, predorsal scales 10, circumpeduncular scales 14; pectorals reaching to ventrals; barbels equal to or slightly longer than eye, tip of dorsal and tips of caudal lobes blackish. The recording of the pharyngeal teeth in the type as 5, 3, that is, in two rows, indicates a defect or an abnormality, as the teeth in this genus are normally triserial.

PUNTIUS FAUCIS, new species

FIGURE 30

Description.—Both head and body strongly compressed; depth 3.4 in standard length; least depth of caudal peduncle about 2 in head and 1.5 in its length; head equal to depth of body; eye 3 in head, equal to interorbital space, and slightly more than snout; mouth small, oblique, lower jaw shorter, maxillary reaching opposite nostrils; rostral and maxillary barbels subequal and about diameter of eye.

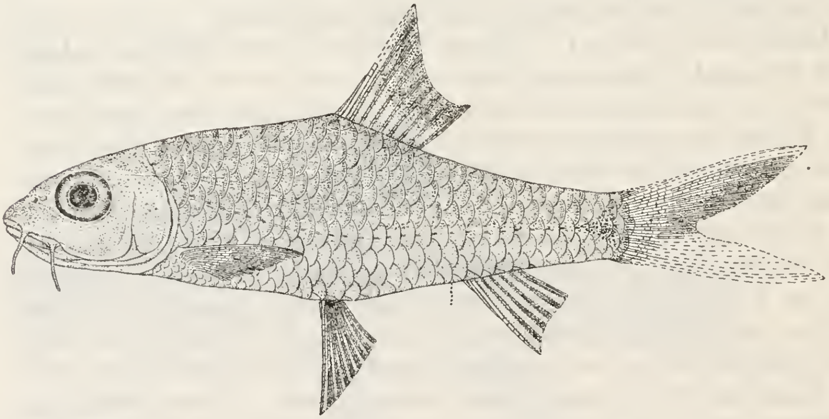


FIGURE 30.—*Puntius faucis*, new species: Type (U.S.N.M. 119497). Drawn by Mrs. Alice C. Mullen.

Squamation: Scales in lateral line 33, in transverse series 5.5–1–3.5, between lateral line and base of ventral fin 2.5, predorsal 12, circumpeduncular 14.

Fins: Dorsal rays iii, 8, last simple ray osseus and nondenticulated; first branched ray somewhat shorter than head; origin of dorsal a little closer to base of caudal than to tip of snout, over tenth scale of lateral line; caudal longer than head, deeply forked, lobes pointed; anal rays iii, 5; ventrals not reaching anal opening; pectorals slightly longer than ventrals, not reaching ventral base, 0.75 head.

Coloration: Plain, silvery white; rays and membranes of dorsal fin blackish distally; caudal fin with a narrow black posterior edge, lobes dusky; other fins plain.

Type.—A specimen in the Deignan collection (U. S. N. M. No. 119497), 5.6 cm. in total length, taken in July 1935 by A. R. Buchanan and P. D. Harrisson, of Chiengmai, in the gorge of the Mechem, tributary of the Meping in Northern Thailand.

Remarks.—This species belongs in the small group of local puntiids characterized by 4 barbels and an osseous simple dorsal ray without serrations, the other members of the group being *P. paucisquamatus* and *P. colemani.* From the former the present species may be readily separated by the more numerous scales (33 in lateral line as against 21, 12 predorsal scales as against 7, and 14 circumpeduncular scales as against 12). From *P. colemani*, to which the resemblance is closer, differences are in the much smaller mouth, shorter maxillary, more numerous predorsal scales; much less advanced position of the dorsal fin as compared with Fowler's figure, markings on the dorsal and caudal fins, etc.

PUNTIUS WETMOREI H. M. Smith

Puntius wetmorei SMITH, 1931a, p. 12 (Menam Chao Phya).

Known from a specimen, 12.5 cm. long, collected in the Menam Chao Phya at Chainad, Central Thailand, January 5, 1925. The relations of the species are shown in the preceding key. The principal features are the large scales (23 or 24 in the lateral line), 12 scales around the narrowest part of the caudal peduncle, 2 pairs of short barbels, last simple dorsal ray osseous and bearing 8 large teeth on its posterior edge, a conspicuous round green spot on each side above the base of the pectoral fin, dark-edged greenish-yellow dorsal fin, and anal, ventral, and pectoral fins bright orange.

PUNTIUS LATERISTRIGA (Cuvier and Valenciennes)

FIGURE 31

Barbus lateristriga CUVIER and VALENCIENNES, 1842, vol. 16, p. 161 (Java).—FOWLER, 1934a, p. 122 (Nakon Sritamarat).

Puntius lateristriga KOUMANS, 1937a, pp. 63, 64 (Peninsular Siam).—FOWLER, 1939, p. 72 (Trang).

While long known from Java, Borneo, Sumatra, and other islands of the Indo-Australian Archipelago as well as from Malacca, this fish was first ascertained to inhabit Thai territory in 1926, when R. Havmöller presented to the Siamese Bureau of Fisheries specimens collected by him in October in a waterfall stream near Tung Song, Peninsular Thailand. Subsequent collecting showed that the fish was generally distributed in Peninsular Thailand—in brooks near the border of Kedah, in waterfall streams on Kao Chong near Trang, in the Tadi River as far west as Ban Kiriwong, and in headwaters of the Tapi River in the district of Bandon.

The largest examples met with in Thailand have been 13.5 cm. long. A length of 18 cm. is reported for the East Indies.

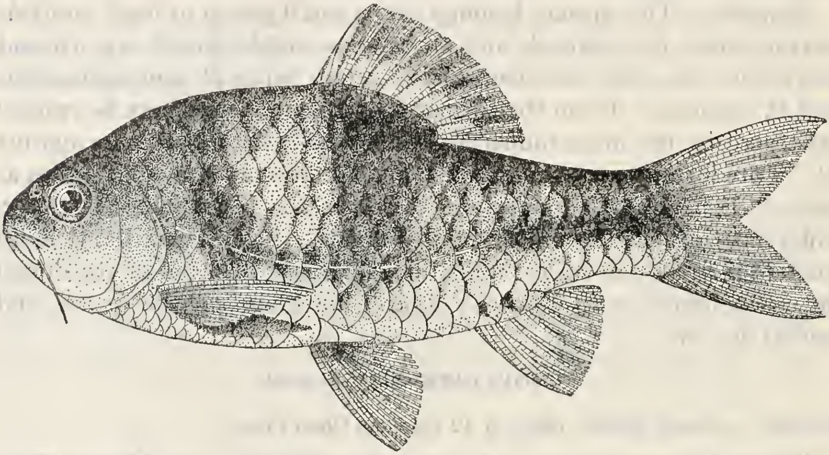


FIGURE 31.—*Puntius lateristriga* (Cuvier and Valenciennes). Drawn by Luang Masya courtesy of the Thailand Government.

The species is strikingly marked in a pattern different from that in any other local cyprinoid—a black blotch on the top of the head, two broad black cross bands on body, a black longitudinal band which may extend between the cross bands, and a small black spot above the base of the anal fin.

The Thai vernacular name for this fish is *plaikong*.

PUNTIUS DARUPHANI H. M. Smith

Puntius (*Barbodes*) *daruphani* SMITH, 1934b, p. 312 (Meping at Raheng, Meklong at Ban Pong).

Barbus daruphani FOWLER, 1937, p. 190, figs. 145, 147 (Mepoon, Kemarat).

In addition to the specimens referred to in the original description, 2 from the Meping at Raheng and 1 from a lake near the Meklong at Ban Pong, there have been examined 2 from the Meklong at Kanburi, 1 from the Menam Nan, 5, from the gorge of the Mechem, and 2 from the Melong, a tributary of the Mechem, which in turn is an affluent of the Meping, these last specimens collected by A. R. Buchanan, of the Borneo Co., Ltd. Fowler reports over 80 specimens from the localities cited.

A length of 18 cm. is attained.

As shown in the foregoing key to the local species of *Puntius*, this form may be recognized by the combination of characters comprising denticulated last simple dorsal ray, 4 barbels, about 27 scales in the lateral line, and 14 scales around the narrowest part of the caudal peduncle.

The general color, varying with age and locality, ranges from golden yellow to silvery green, with a dark brown base to the scales of back and sides; the dorsal and caudal fins are usually hyaline green; the anal fin may be milky white anteriorly and bright orange posteriorly; the ventrals and pectorals are orange or yellow.

The fish seems to be distinguished by the local fishermen from related species and it is called *pla tapak* at Raheng and Ban Pong, while on the Nan River it bears the name *pla peek.*

PUNTIUS BINOTATUS (Cuvier and Valenciennes)

Barbus binotatus Cuvier and Valenciennes, 1842, vol. 16, p. 168 (Java).—Fowler, 1934a, p. 122, figs. 79, 80 (Chiengmai, Chiengsen, Chiengdao, Bua Yai, Bangkok, Nakon Sritamarat, Chantabun); 1935a, p. 121 (Khao Nam Poo, Bangkok); 1937, p. 198 (Tachin, Mepoon, Pitsanulok, Rayong).

Barbus (*Puntius*) *binotatus* Hora, 1923b, p. 156 (Koh Chang).

Puntius binotatus Masya and Indrambarya, 1932, p. 280 (Koh Samui, Koh Pangan).—Koumans, 1937a, p. 63 (Kapa).—Fowler, 1939, pp. 40, 72 (Huey Yang, Trang).

Of wide distribution in the Indo-Australian Archipelago and Malaya, this little fish is likewise found abundantly over a large part of Northern, Central, Southeastern, and Peninsular Thailand but it has not been reported from Eastern and Western Thailand. A favorite resort is the mountain streams on islands; and the fish may be said to be a characteristic element of the fresh-water fauna of Koh Chang, Koh Samui, and Koh Pa-ngan, large islands in the Gulf of Siam. Other mountain streams inhabited by the fish are on Kao Sabap and Kao Bantad, Southeastern area; on Kao Chong and other mountains in the Peninsula; and various rivers and brooks in Northern Thailand, including some tributary to the Mekong. In the Central district the fish descends as far as Bangkok.

A length of 20 cm. or somewhat over is attained.

The species is subject to considerable variation in markings dependent on age. Young specimens always show a round black spot on the back at the base of the anterior dorsal rays and another on the caudal peduncle near the base of the caudal fin; these spots persist with growth and are often the only markings shown, but in large specimens they may be absent. In the young there is an irregular series of small black spots along the longitudinal axis; these spots later become confluent and form a band that in larger examples grows faint and may entirely disappear. In the young there is at the base of the anal fin a small black spot that disappears with growth.

Two figures showing variations in *Puntius binotatus* are given by Fowler (1934a); his figure 79, however, representing a male fish 18 cm. long, does not seem to be this species, as it shows a sharply defined black submarginal band on each caudal lobe, a peculiarity of coloration not otherwise known in *P. binotatus.* It is suggested that this example, together with those from Chiengmai described as having a "spot on gills cherry red. Fins all like sealing wax, dorsal and caudal edged with black" may be *Puntius orphoides*, a species characteristically marked as stated and moreover having 31 to 34 scales in the lateral line (33 in Fowler's figure), while *P. binotatus* has 23 to 27 lateral line scales (26 in Fowler's figure).

PUNTIUS VERNAYI (Norman)

Barbus vernayi NORMAN, 1925, p. 315 (Mewong).

Described from two specimens, 13.5 and 18.5 cm. long, collected by Arthur S. Vernay in the Mewong east of Umpang in west-central Thailand, this species has not since been recognized.

PUNTIUS BEASLEYI (Fowler)

Barbus beasleyi FOWLER, 1937, p. 194, figs. 153, 154 (Kemarat).

This species is known from a single specimen, 6.2 cm. long, from the Mekong at Kemarat. It has four barbels and plain coloration, but Fowler states that it resembles *P. pessuliferus*, a species with a single pair of barbels, a series of short black vertical bars on the side, and a black spot on the back at the anterior base of the dorsal fin. The closest relationship appears to be with *P. vernayi.*

PUNTIUS FOXI (Fowler)

Barbus foxi FOWLER, 1937, p. 188, figs. 144, 145; (Kemarat).

Described from two specimens, 5.2 and 5.7 cm. long, from the Mekong at Kemarat, Eastern Thailand, and known only from that point, this species is described as characterized by a large black apical blotch on the dorsal fin, with a narrow pale margin anteriorly and distally.

PUNTIUS HUGUENINI (Bleeker)

Barbus huguenini BLEEKER, 1853 (76), p. 294 (Ombiling River, Sumatra).

Described by Bleeker in 1853 from a specimen from the Ombiling River in Sumatra, this species has proved to be very rare. In addition to possessing the type, the British Museum has a specimen from Lake Korinche, Sumatra, collected by Robinson and Kloss, and another from the Palom River, Pahang, Federated Malay States, collected by Vernay; the last specimen, however, is doubtfully referred to this species. The only other specimens known appear to be two collected by Deignan in Northern Thailand, one from the Mekong at Chiengsen Kao, January 9, 1937, the other from the Mekok at Chiengrai, January 25, 1937.

Characters by which this species has been distinguished are: Rather deep body, the depth contained 2.4 to 2.75 in standard length; 30 or 31 scales in lateral line, 5.5 scales above lateral line, 2.5 or 3 scales between lateral line and origin of ventral fin, 10 predorsal scales (11 and 12 in Thai specimens), 14 scales around the caudal peduncle; well-developed rostral and maxillary barbels; and last simple dorsal ray osseous and denticulated.

The specimen from the Mekong, 26.5 cm. in total length, was sent to the British Museum and compared by Dr. Ethelwynn Trewavas with the type and other material in that institution. The specimen was found to "agree rather well with the type, differing mainly in the longer barbels, deeper body and incomplete lateral line." Both rostral and maxillary barbels in the type are 0.75 the diameter of the eye; in the second Sumatran specimen the rostral barbel equals the diameter of the eye, and the maxillary barbel is 1.3 times the diameter of the eye, while in the Thai example both barbels are 1.75 times the diameter of the eye. The depth of the body in standard length is 2.75, 2.4, and 2.3 in the three specimens. The lateral line varies markedly in the material available, being complete in the type, absent in the second example from Sumatra, incomplete in one of the Thai specimens and complete though rather weak in the other. The gill rakers on the lower arm of the first arch number 5 and 6 and 7 and 10, respectively, in the Sumatran and Thai specimens.

PUNTIUS SIMUS, new species

Figure 32

Description.—Comparatively short, moderately compressed, dorsal and ventral profiles similar; depth of body 3 in standard length; depth of caudal peduncle 1.3 in its length and 2 in head; head about 3.5 in length, its width 1.6 in its length; snout short, blunt, 4.3 in head, 1.3 in eye; eye far in advance of midlength of head, 3.3 in head, 1.6 in interorbital space; nasal flap expanded into a nearly circular shape; maxillary barbel 0.8 diameter of eye; mouth terminal, oblique, strongly arched, wide as eye, maxillary extending under anterior margin of eye.

Squamation: Lateral line complete, with 31 tube-bearing scales; scales in transverse series from midline of back to base of ventral fin 4.5–1–3; predorsal scales 10; circumpeduncular scales 16.

Fins: Origin of dorsal fin midway between tip of snout and base of caudal fin, over eighth scale of lateral line, opposite origin of ventrals;

dorsal slightly emarginate, rays iii, 8, last simple ray feebly denticulated on its posterior edge; last branched dorsal ray 3.3 in head; caudal slightly longer than head, forked for half its length, the lobes pointed; anal rays iii, 5, longest 0.6 head; ventrals i, 8, somewhat shorter than pectorals; pectorals i, 14, 1.6 in head, not reaching ventrals.

Coloration: Silvery; back and top of head olive; scales of side with an obscure dark basal spot; a dusky-green area on opercle; a narrow blackish stripe immediately behind the head extending from upper angle of gill opening to base of pectoral fin; a jet black spot on caudal peduncle involving the twenty-sixth to the twenty-ninth scales of lateral line, about size of eye and shaped like the spade of playing cards, with the stem directed forward; fins plain.

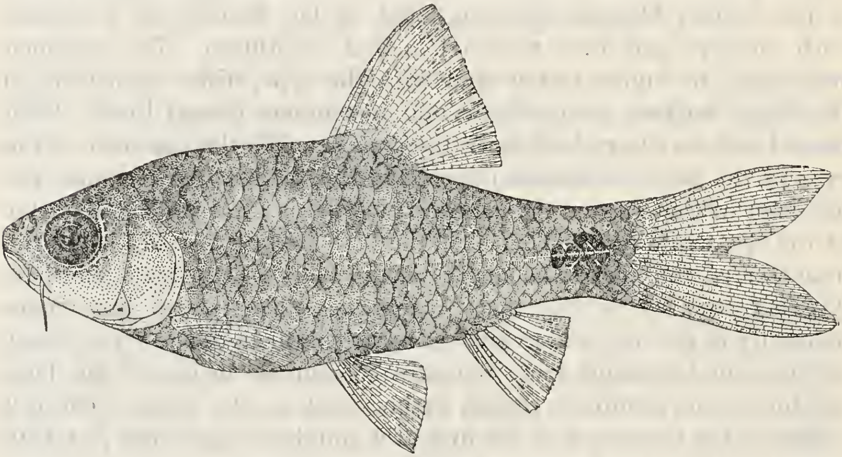


Figure 32.—*Puntius simus*, new species: Type (U.S.N.M. No. 119452). Drawn by Mrs. Aime M. Awl.

Type.—The type and only know specimen (U.S.N.M. No. 119452), 5.9 cm. long, was taken by H. G. Diegnan on December 25, 1936, in the Huey Melin, a branch of the Menam Mao, Northern Thailand.

Remarks.—The Huey Melin at Ban Muang Sum where this fish was taken is a tiny, clear brook.

The species belongs in the section of *Puntius* having as local members *bramoides*, *jolamarki*, and *sarana*, characterized by 4 barbels, complete lateral line with about 28 to 32 scales, 16 scales around the caudal peduncle, last simple dorsal ray osseous and denticulated, and 5 simple rays in the anal fin.

From all these, as well as from similar Burman and Indian species, the present form is separable by its small, broad head and short, blunt snout, combined with the jet black spot, of peculiar shape, on the caudal peduncle.

(*Simus*, snub-nosed.)

PUNTIUS BRAMOIDES (Cuvier and Valenciennes)

Barbus bramoides Cuvier and Valenciennes, 1842, vol. 16, p. 160 (Java).

Puntius (*Barbodes*) *erythropterus* Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).

Barbus (*Puntius*) *bramoides* Peters, 1868, p. 272 (Siam).—von Martens, 1876, p. 402 (Bangkok).

Puntius erythropterus Sauvage, 1881, p. 163 (Siam).

Puntius bramoides Sauvage, 1883b, p. 153 (Menam Chao Phya).—Weber and de Beaufort, 1916, vol. 3, p. 195 (Siam).—Fowler, 1934a, p. 125 (Chiengrai, Chiengsen); 1935b, p. 510 (Old Chiengsen).

This species of Borneo and Java has long been known from Thailand from collections made by Jagor in 1861, reported on by Peters in 1868. Recently Herre and Myers (1937) have bridged the gap between Borneo and Thailand by reporting the species from two of the Malay States. In Thailand the fish is uncommon and has a rather limited distribution in the lower Menam Chao Phya. The presence of the fish in the Meping drainage was disclosed by a specimen collected by Deignan in a small pond in the grounds of the leper asylum near Chiengmai; this pond, densely overgrown with aquatic vegetation, is connected with the Meping but is usually shut off by a flood gate; at the annual drainage of the pond in June 1935, a *Puntius bramoides* 23.5 cm. long was taken. Fowler (1934a) extended the range to the Mekong basin.

Specimens examined in Thailand have been 15.7 to 22 cm. long, the largest from a pond in Bangkok connected with the Chao Phya River. A length of 30 cm. is recorded for the East Indies.

Weber and de Beaufort (*loc. cit.*) credit this species with having three simple and only 5 branched rays in the anal fin. The specimen at hand from Chiengmai shows seven branched anal rays, a larger number than previously noted, but is otherwise in agreement with the published description. Bleeker (301) (1863, vol. 3, p. 95) gives five and six branched anal rays for the species, and his plate shows six.

The fish shares with related forms in Thailand the vernacular name of *pla tapien khao*.

PUNTIUS SARANA (Hamilton)

Cyprinus sarana Hamilton, 1822, pp. 307, 388 (India).

A specimen of *Puntius sarana* collected by Vernay in the Mewong, Central Thialand, is in the British Museum. It is the only known instance of the finding of this fish in that country. The species has a wide range in India and Burma and may be looked for in the Salwin drainage in Thailand.

It bears a strong resemblance to *P. orphoides* and seems to differ mostly in coloration: The opercles are not referred to as having a red area, the fins are not red, and typical *P. sarana* has no dark marginal bands on the caudal lobes. Day (Fishes of India), however, notes that the young may have a dull blotch on the lateral line just below the caudal base, that there are mostly some dark spots behind the opercle, and that specimens from Burma sometimes have a black upper and lower edge to the caudal lobes.

A length of 30 cm. or more is reached.

PUNTIUS JOLAMARKI H. M. Smith

Puntius (*Barbodes*) *jolamarki* Smith, 1934b, p. 310 (Menam Chao Phya).
Barbus jolamarki Fowler, 1937, p. 194, figs. 155, 156 (Pitsanulok).

Originally known only from two specimens, 12.5 and 14.2 cm. long, from the Menam Chao Phya at Bangkok, this species will no doubt be found throughout that river. Fowler records 51 specimens, 6 to 10.9 cm. long, from Pitsanulok.

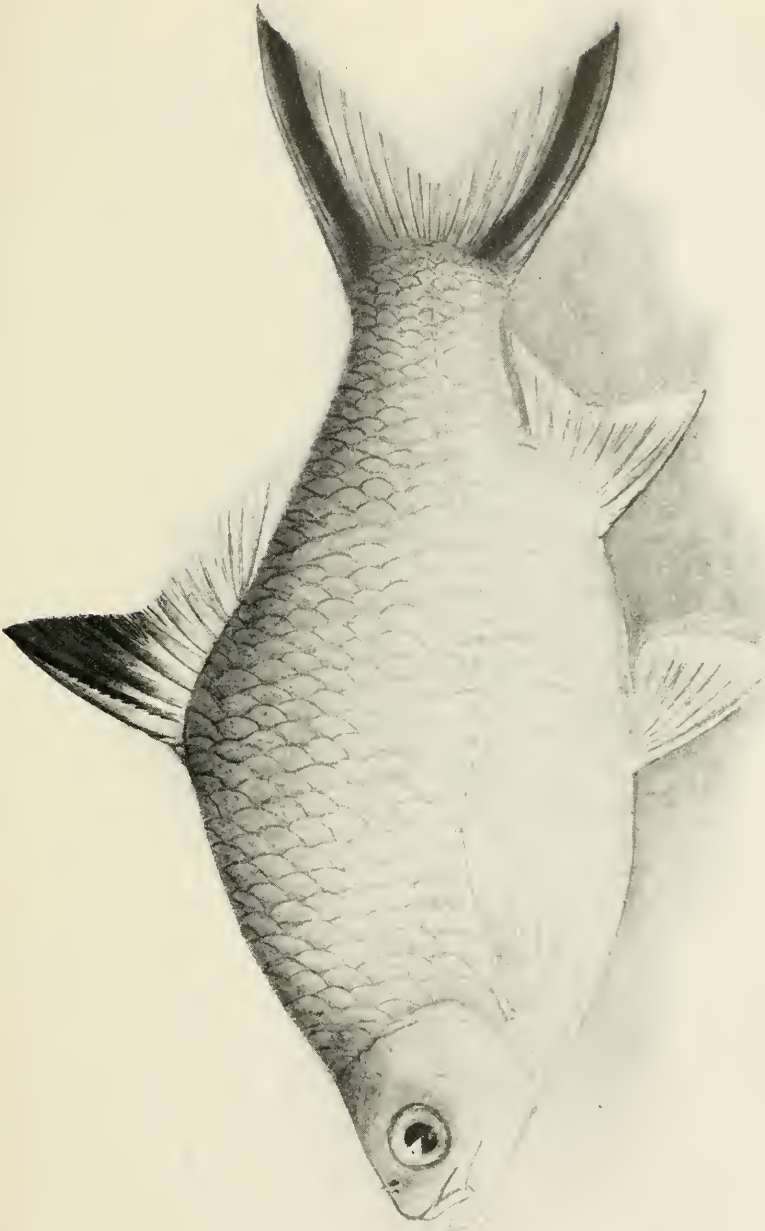
PUNTIUS GONIONOTUS (Bleeker)

Barbus gonionotus Bleeker, 1850 (25), p. 15 (Surabaya, Java).—Günther, 1868, vol. 7, p. 119 (Siam).
Puntius (*Barbodes*) *javanicus* Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).
Barbus (*Puntius*) *javanicus* von Martens, 1876, p. 402 (Petchaburi).—Hora, 1924a, p. 470 (Tale Sap).
Puntius javanicus Sauvage, 1881, p. 163 (Siam).—Weber and de Beaufort, 1916, vol. 3, p. 197 (Siam).
Barbus (*Puntius*) *javanicus* Hora, 1923b, p. 155 (Bangkok).
Puntius gonionotus Sauvage, 1881, p. 163 (Siam).
Barbus javanicus Fowler, 1934a, p. 125 (Chiengmai); 1934b, p. 346 (Bangkok); 1935a, p. 121 (Bangkok); 1937, p. 196 (Bangkok, Mepoon, Pitsanulok, Kemarat).

This species of Java and Sumatra occurs throughout the length of Thailand but is commonest in rivers of the Central region, especially the Menam Chao Phya, the Nakon Nayok, the Pasak, the Sikuk, and the Meklong. It is not an outstanding species in Northern Peninsular, and Eastern Thailand, and appears to be absent from the Southeastern district.

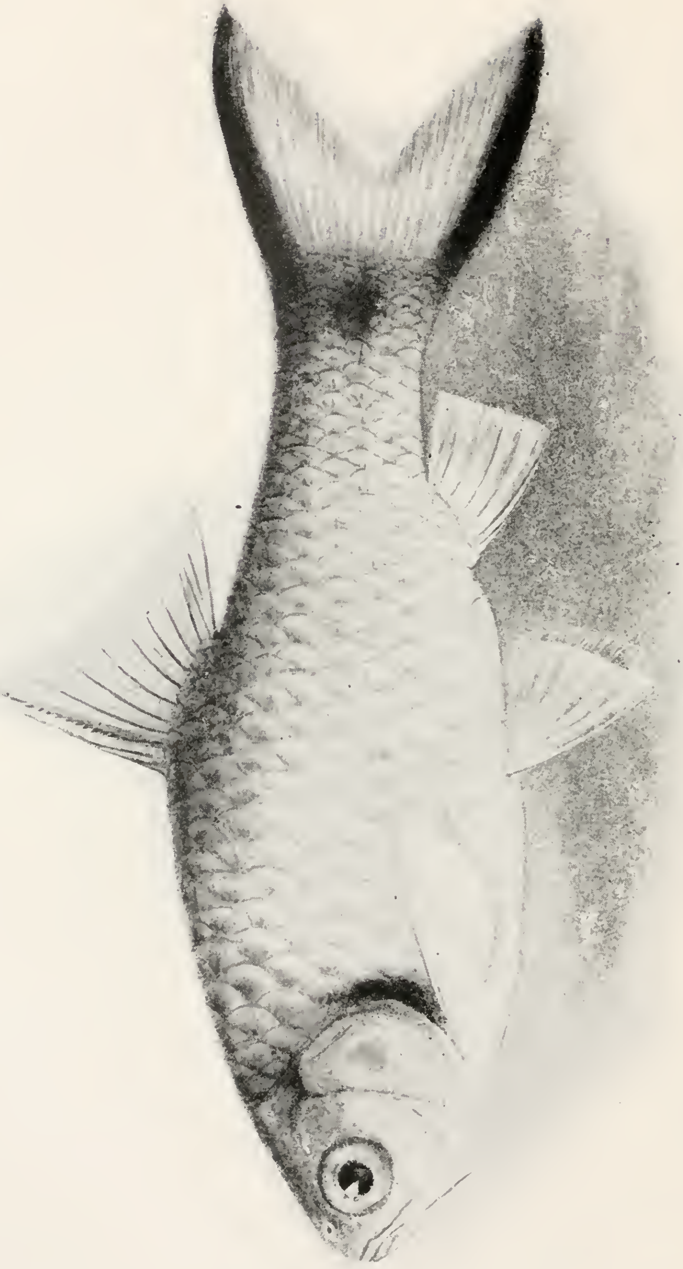
The largest example met with was a female taken in the Pasak below the barrage at Dha Luang February 26, 1925; it was 32.5 cm. in total length, 25.5 cm. to the caudal base, and 11.5 cm. deep.

The name *gonionotus* (Bleeker, 1850 [25]) seems to have clear priority over *javanicus* (Bleeker, 1855 [138], p. 403), but the latter has been used by most of the recent authors.



PUNTIUS SCHWANENFELDII BLEEKER).

Drawn by Luang Masya; courtesy of the Thailand Government.



PUNTIUS ORPHOIDES (CUVIER AND VALENCIENNES)

Drawn by Luang Masya; courtesy of the Thailand Government.

The fish is caught in large quantities for domestic consumption and sale and is well known to fishermen and the general public under the name *pla tapien khao* (*khao*, white).

PUNTIUS ALTUS (Günther)

? *Puntius* (*Barbodes*) *bocourti* BLEEKER, 1865 (347), p. 35 (nomen nudum) (Siam); 1865 (356), p. 176 (nomen nudum) (Siam). (*Fide* Sauvage.)

Barbus altus GÜNTHER, 1868, vol. 7, p. 119 (Siam).—FOWLER, 1937, p. 198, figs. 163, 164, 167, 168 (Bangkok, Parkman, Kemarat).

Barbus (*Puntius*) *altus* VON MARTENS, 1876, p. 402 (Petchaburi).

Puntius altus SAUVAGE, 1881, p. 163 (Menam Chao Phya).—FOWLER, 1939, p. 45 (Krabi).

This species was established by Günther from three specimens, 3 to 3.5 inches long, contained in the Thai collections of Mouhot and Jamrach in the British Museum, which institution has also numerous other specimens from the Menam Chao Phya, received from the Siamese Museum.

With the exception of one specimen, 5.8 cm. long, listed by Fowler from Kemarat on the Mekong in Eastern Thailand and two specimens in the British Museum collected by Bock and assigned to "Western Siam," the species has been known only from Central Thailand. Fowler (1939), however, recorded from Krabi in the Peninsula a number of full-sized specimens that differ from any previously observed in having a dark longitudinal band on each caudal lobe.

A specimen from Bangkok figured by Fowler is 15 cm. long.

The characters that distinguish this species are the deep body (equal to about half the standard length), two pairs of barbels equal to or shorter than eye, short and obtuse snout shorter than eye, 8 rows of scales between the origin of the dorsal fin and the lateral line, well-developed scaly sheaths of the dorsal and anal fins, origin of the dorsal fin posterior to a vertical from the origin of the ventrals, strongly ossified last simple dorsal ray with 8 to 12 antrorse serrae, deeply forked caudal fin, and plain coloration, with the anterior distal part of the dorsal fin blackish.

Bleeker, in 1865 [347], in a mere list of names of fishes collected in Thailand by Bocourt, gave *Puntius* (*Barbodes*) *bocourti*, new species. No description was ever published. In another list of Thai fishes issued in the same year, Bleeker simply recorded the species as *Puntius* (*Barbodes*) *bocourti* Bleeker. While the fish in question doubtless represented an undescribed species, the name given to it by Bleeker had no standing, and the only clue to the identity of the fish is afforded by Sauvage (1881) who, in a list of fishes found in Indo-China, Thailand, and the East Indies, indicated in a footnote to *Puntius altus* that *Puntius bocourti* was the same fish.

PUNTIUS SCHWANENFELDII (Bleeker)

PLATE 4

Barbus schwanenfeldii BLEEKER, 1853 (86), p. 517 (Sumatra).

Barbus (*Puntius*) *schwanefeldi* VON MARTENS, 1876, p. 402 (Bangkok).—HORA, 1923b, p. 156 (Bangkok, Nontaburi).—VIPULYA, 1923, p. 226 (Bangkok).

Puntius schwanefeldi WEBER and DE BEAUFORT, 1916, vol. 3, p. 178 (Siam).—KOUMANS, 1937a, pp. 63, 64 (Peninsular Siam).

Barbus schwanefeldii FOWLER, 1934a, p. 122 (Chiengmai); 1935a, p. 121 (Srisawat).

A common and widely distributed species of Thailand, known also from Malaya, Sumatra, and Borneo. Specimens have been examined from the Patani River, the Tale Sap, the Tale Noi, and the Tapi River in Peninsular Siam; the Meklong, Tachin, Chao Phya, and Sikuk Rivers in Central Thailand; the Chantabun River in Southeastern Thailand; the Mun River in Eastern Thailand; and the Mekok at Chiengrai, Northern Thailand.

The fish reaches a length of 35 cm. The largest observed in Siam, taken in the Chantabun River, was 29 cm. long. The usual length of fully mature fish is 15 to 20 cm.

This is a beautiful fish, with the body silvery or golden yellow, the dorsal fin red, with a large black blotch anteriorly, the caudal fin orange or blood-red, with a submarginal black or dark bluish band on each lobe, the anal and ventral fins bright orange or blood red, the pectoral fins greenish yellow, the opercle brassy, and the iris yellow.

Over most of its range in Thailand the fish is called *pla kahae*. In Peninsular Siam, where there is a large Malay element in the population, the fish bears the name *pla lampam*, *lampam* or *pampan* being the Malay designation.

PUNTIUS ASHMEADI (Fowler)

Barbus ashmeadi FOWLER, 1937, p. 193, figs. 151, 152 (Kemarat).

Three specimens, 5.3 to 7.7 cm. long, from the Mekong at Kemarat are the basis for this species. It is similar to *P. foxi* in having a large black blotch at the apex of the dorsal fin, but differs in being slenderer and having shorter barbels.

PUNTIUS ORPHOIDES (Cuvier and Valenciennes)

PLATE 5

Barbus orphoides CUVIER and VALENCIENNES, 1842, vol. 16, p. 193 (Java).—FOWLER, 1934a, p. 125 (Metang, Chiengmai); 1937, p. 192, fig. 148 (Bangkok, Pitsanulok, Mepoon, Tachin).

Puntius (*Barbodes*) *rubripinna* BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).

Barbus (*Puntius*) *rubripinnis* PETERS, 1868, p. 272 (Siam).

Puntius rubripinna SAUVAGE, 1881, p. 163 (Siam).

Puntius orphoides Weber and de Beaufort, 1916, vol. 3, p. 193 (Siam).—Fowler, 1939, pp. 45, 72 (Peninsular Siam).

Although this fish is known from Borneo and Java it has apparently not been detected in Malaya. It covers all of Thailand except the waters tributary to the Salwin and others in the western drainage. It is not numerous in the Tale Sap but is very common in streams in and near the town of Nakon Sritamarat. It reaches its greatest abundance in Central Thailand and in waters of Northern Thailand tributary to the Menam Chao Phya, including the upper Menam Nan where Deignan collected numerous specimens in 1936. The fish abounds also in Thailand waters of the Mekong watershed and is known from Lake Payao and its connecting streams and lakes; the Menam Mao (a branch of the Menam Fang), where in December 1936 Deignan obtained this species in the first fish collections made in that area, and throughout the Menam Mun from its headwaters near Pakjong. It occurs in Chantabun River and other streams in the Southeastern regions, and pushes its way up the brooks on Kao Sabap. In the Khun Tan Mountains, Northern area, it has been taken in Huey Luk at an elevation of 2,000 feet.

This fish reaches a length of 25 cm. The largest actually examined in Thailand were 22 cm. long. Full maturity may be attained and spawning take place at 8 cm. or somewhat less. A specimen 9.5 cm. long from Huey Lom, an affluent of the upper Menam Nan, June 1936, was greatly distended with nearly ripe eggs; another 8 cm. long taken at the same time and place had well-developed ovaries; while two males from the same lot were 6.5 and 7 cm. long.

This is perhaps the most beautiful local member of the genus. In a mature example the body and head are bright silvery, with the back brownish or bluish; there is a blood-red area on the opercle, the barbels are green, and the upper part of the iris is blood-red; a transverse black bar marks the posterior margin to the gill opening; the dorsal, anal, and vertical fins are blood-red; the caudal is red, with a longitudinal black marginal band on each lobe, and the pectoral is salmon color. Some specimens show longitudinal dark lines on back and sides following the rows of scales. In young up to 8 to 10 cm. long there may be a very distinct round black spot on the back under the anterior part of the dorsal fin (not referred to in any descriptions), and there is a black spot on the caudal peduncle at the base of the caudal fin. The markings may under certain conditions be faint or lacking. Thus in eight bright silvery specimens taken in the clear, shallow Meping at Chiengdao, Northern Thailand, January 28, 1932, there were no red area on the cheeks, no black band along the gill opening, and no dark bands on the caudal lobes, but the black spots under the dorsal fin and on the caudal peduncle were present.

Some specimens from the headwaters of the Menam Mun at Pakjong have shown only 14 scales surrounding the narrowest part of the caudal peduncle (16 the typical number). One specimen from a lot taken in the Meping at Chiengmai had only 7 branched dorsal rays (all the others 8). A curious abnormality in a specimen 8.3 cm. long from a waterfall brook on Kao Sabap, Southeastern Thailand, was in the lateral line of the right side which, instead of being continuous as on the left side, dropped to the next lower row of scales after the fifth scale. Still another aberrant specimen from Nong Yang, a lake back of Sriracha in Southeastern Thailand, has on one side 5.5 rows of scales between the midline of the back and the lateral line and on the other side 4.5 rows.

Eight specimens, the largest 11.2 cm. long, collected by the writer from the Meping near the base of Doi Chiengdao, Northern Thailand, January 20, 1932, are in general agreement with *P. orphoides*, with 16 scales around the narrowest part of the caudal peduncle.

The singularly apt name of *pla kam cham* (bruised-cheek fish) is borne by this fish in most parts of Central Thailand. In Nakon Sritamarat the fish is called *pla labok*. Along the Meping, at Chiengmai, and at Chiengdao, the people know this species as *pla pok* or *pla sa pok*, while on the Meyom a variant name is *pla pok som*. Still another name, heard along the Menam Mun near Korat in Eastern Thailand, is *pla hao smoh muk*.

DOUBTFUL OR INVALID SPECIES OF PUNTIUS ASCRIBED TO THAILAND

PUNTIUS BOCOURTI Bleeker

Puntius (*Barbodes*) *bocourti* BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).

In the first paper cited, Bleeker simply named this fish as a new species, and elsewhere in the text he mentioned it and others as "restent à décrire." In the second paper the species is listed without comment. No description has ever appeared, and the species has no standing. Sauvage (1881) in a mere footnote without any explanation cites *Puntius bocourti* as the same as *P. altus* (Günther). As Sauvage had access to the material that Bleeker so named, his course may be followed. See *Puntius altus*, p. 189.

PUNTIUS LAOENSIS (Günther)

Barbus laoensis GÜNTHER, 1868, vol. 7, p. 115 (Laos Mountains, Cochin China).
Puntius laoensis SAUVAGE, 1881, p. 163 ("Laos, Petschaburi, en Siam.")

This fish was described by Günther from a specimen 3.75 inches long, collected by the explorer Mouhot in the Laos Mountains of the present Province of Laos of French Indo-China, although Günther assigns it to Cochin China. The species would require no notice in the present connection if Sauvage had not mentioned it incidentally as coming from "Petschaburi" as well as from Laos. Petchaburi is a town in the southwestern part of Central Thailand. Pechabun or Pachebun is a small community on the Pasak River on the eastern border of Central Thailand, a region in which Mouhot made fish collections. The fish was described as having 4 barbels, an ossified and serrated simple dorsal ray, 30 scales in the lateral line and 3 rows of scales between the lateral line and the base of the ventral, and the depth of body one-third the standard length (a feature of little significance in a specimen so small as the type). Günther's description would be more or less applicable in part to several Thai species recently named, and the status of this species as a Thai fish is doubtful.

PUNTIUS BALLEROIDES (Cuvier and Valenciennes)

Barbus balleroides CUVIER and VALENCIENNES, 1842, vol. 16 (?Surinam).
Barbus (*Puntius*) *balleroides* VON MARTENS, 1876, p. 402 (Bangkok).
Puntius balleroides SAUVAGE, 1881, p. 163 (nomen nudum) (Bangkok).

The original description of *Barbus balleroides*, although quite full for the time, did not bring out characters by which the species might be distinguished from related forms. Recent collecting in Thailand has yielded no specimens that could be referred to this species, said to have the depth 5 in standard length, 4 well-developed barbels, lateral-line scales 30, transverse line scales 13, dorsal rays iv, 8, the last simple ray strong and denticulated, and anal rays iii, 5. Günther (1868, vol. 7, p. 115), copying the description of Cuvier and Valenciennes, placed the species between *Barbus laoensis* (Günther) and *B. sarana* (Hamilton).

The species is listed from Bangkok by von Martens (1876) and by Sauvage (1881) but without description, Sauvage simply mentioning the fish as having been collected by Bocourt. Although the collector of the type reported it as coming from Surinam (Dutch Guiana), Valenciennes questioned the locality, and the habitat of the species remains as uncertain as its relationships.

PUNTIUS SIAMENSIS Sauvage

Puntius siamensis SAUVAGE, 1883b, p. 152 (Menam Chao Phya).

This species was based on a specimen, 11 cm. long, collected in the Menam Chao Phya by Dr. Harmand. It was characterized by 4 barbels, comparatively large scales (28 in lateral line), and a strongly ossified denticulated last simple dorsal ray. The ventrals are said to be below the middle part of the dorsal. The edge of each scale and the tip of the dorsal were black.

The fish has not since been collected or recognized, and its status is uncertain. The anal rays were said to number 11. If it is assumed that the simple rays number 3, the maximum recorded in this genus, there would be 8 branched rays, more than in any known species of *Puntius*. Sauvage's reference to pores on the snout ("des pores au museum") further suggests that the fish is not a *Puntius*, as the definition of this genus excludes fish with pores or tubercles on the snout.

PUNTIUS PINNAURATUS (Day)

Cyclocheilichthys pinnauratus DAY, 1865, p. 300 (Cochin, India).
Barbus pinnauratus KÁROLI, 1882, p. 179 (Siam).

Doubt must be thrown on the reported occurrence of this species in Thailand. It is definitely known only from India and Ceylon.

Genus PUNTIOPLITES H. M. Smith

Puntioplites H. M. SMITH, Journ. Siam Soc., Nat. Hist. Suppl., vol. 8, p. 11, 1929. (Type, *Puntius* (*Puntius*) *proctozysron* Bleeker.)

This genus was established in 1929 for puntiid fishes having a large, strongly ossified, serrated anal spine. In no other puntiid fish is the anal spine serrated, although in several species of *Puntius* that spine is large and ossified. The subgenus *Adamacypris* was proposed for the same fish by Fowler (1934a) but was later suppressed as a synonym of *Puntioplites*.

PUNTIOPLITES PROCTOZYSRON (Bleeker)

Puntius (*Puntius*) *proctozysron* BLEEKER, 1865 (347), p. 35 (nomen nudum) (Siam); 1865 (356), p. 176 (nomen nudum) (Siam); 1865 (360), p. 200, pl. (Bangkok, Ayuthia).
Barbus (*Puntius*) *proctozysron* VON MARTENS, 1876, p. 402 (Petchaburi).
Puntius proctozysron SAUVAGE, 1881, pp. 163, 184 (Siam, Cochinchina, Grand Lakes of Cambodia).—SMITH, 1927c, p. 195 (Siam); 1929, p. 11 (Siam). (New generic name *Puntioplites* proposed.)
Barbus proctozysron WEBER and DE BEAUFORT, 1916, vol. 3, p. 200 (footnote) (Siam).—FOWLER, 1934b, p. 346 (Bangkok); 1935a, p. 121 (Bangkok).
Puntius smithi HORA, 1923b, p. 156, pl. 11, fig. 1 (Bangkok).
Puntius falcifer SMITH, 1929, p. 11 (Mekong basin).
Puntioplites proctozysron CHEVEY, 1932b, p. 32, fig. 6, pl. 9 (Siam, Cochinchina, Cambodia).—FOWLER, 1937, p. 198 (Bangkok, Mepoon, Pitsanulok, Kemarat); 1939, p. 45 (Krabi).
Barbus (*Adamacypris*) *proctozysron* FOWLER, 1934a, p. 125, fig. 82 (Chiengmai, Chiengsen, Bangkok).

This fish is fairly common and has a wide range in Thailand. It is recorded from the extreme north, in the Meping and Mekong drainages; throughout Central Thailand; from the Mekong and various tributaries in Eastern Thailand; and from the Peninsula. The only regions from which it has not been reported are Southeastern Thailand and from the Salwin basin and other waters tributary to the

Bay of Bengal. The only other habitat is the Mekong in Cochinchina and Cambodia, and, inferentially, in Laos.

In recording this species from Thailand as well as from Cochinchina and Cambodia, Sauvage (1881) described a specimen 20 cm. long and noted that the type of the species, in the Museum of Natural History in Paris, was collected at "Pexabury" by Bocourt. It is not a matter of great importance, but it may be pointed out that the five specimens that Bleeker (1865 [360]) had in hand when he first described and named the species were stated to be from Bangkok and Ayuthia.

The usual length of adult fish taken in Central Thailand is 13 to 15 cm., but examples up to 20 to 21 cm. are not rare, and a number 22 to 22.5 cm. have been observed, representing about the maximum size known to be attained. In the Mekong basin in Eastern Thailand this fish regularly reaches a larger size than has been met with elsewhere. Examples over 30 cm. long are common, and in such the anterior dorsal rays are greatly elongated and falciform. This feature was once thought by the writer (Smith, 1929) to be of specific significance and the name *Puntioplites falcifer* was given to the fish so characterized. At the present time, however, with the information available, it is not possible to consider the greatly developed dorsal fin as more than an age or size character.

Fishermen are able to recognize this fish at once by its large, serrated anal spine, and in most places give it a special name, *pla kamang*, heard throughout Central Thailand and also along the Mun River in Eastern Thailand, sometimes shortened to *pla mang* (as in Bung Borapet). Vernacular names of rather local usage are *pla liam* (angular fish) at Paknampo, *pla wi* at Chiengrai, and *pla pae* at Bandon.

Genus CHAGUNIUS H. M. Smith

Chagunius H. M. Smith, Proc. Biol. Soc. Washington, vol. 51, p. 157, 1938. (Type, *Cyprinus chagunio* Hamilton.)

CHAGUNIUS CHAGUNIO (Hamilton)

Cyprinus chagunio Hamilton, 1822, pp. 295, 385 ("The Yamuna, and in the northern rivers of Behar and Bengal").

Chagunius chagunio Smith, 1938a, p. 157 (India, Burma, Siam).

This very interesting and strongly characterized species, first given a definite scientific status by Hamilton in 1822 and later recognized as having a wide range over northern India, was added to the Thai fauna by collections made by H. G. Deignan in October 1936, in the Salwin at Ta Fang and in the Huey Mekong Kha, a tributary of the Salwin, at the base of Doi Mekong Kha. The Thai specimens, three in number, have been compared with specimens collected by Dr. S. L. Hora at Dehra Dun, in the Punjab, India, and found to agree.

In India the fishes reach a length of 45 cm. or more. The Indian specimens in hand are 20 to 22 cm. The largest Thai examples are upward of 12 cm., at which size the fish is immature.

This fish was for many years carried in the composite genus *Barbus.* In 1938 the genus *Chagunius* was established by the writer for its accommodation. Outstanding characters are the compressed head with flat sides; well-developed rostral and maxillary barbels; division of the overhanging snout into a central and two lateral lobes by a groove extending upward and forward from the base of each rostral barbel; narrow suborbital bones; gill openings extending well forward, gill membranes narrowly joined to the isthmus; gill rakers on lower arm of first arch represented by 9 triangular plates; pharyngeal teeth in 3 rows; snout and cheeks in male thickly beset with short, horny tubercles, which are smaller and fewer in females; dorsal rays iii, 8 or iv, 8, last simple ray osseous and coarsely serrated; anal fin with 5 branched rays of which the last 2 rays in the adult male are greatly elongated; rows of papillae along the pectoral, ventral, anal, and caudal rays in male.

Both the generic and specific names are based on the native vernacular *chaguni*, borne by this fish in the state of Bihar.

Genus ACROSSOCHEILUS Oshima

Acrossocheilus Oshima, Ann. Carnegie Mus., vol. 12, p. 206, 1919. (Type, *Gymnostomus formosanus* Regan.)

The generic name *Acrossocheilus*, given by Oshima to a Formosan species (*formosanus*) characterized by the separation of the lower lip into two lateral parts, leaving the median portion of the lower jaw exposed, is here used with some hesitation for the group of fishes of Southeastern Asia formerly called *Lissochilus.* The genus *Lissochilus*, as defined by Weber and de Beaufort (1916, vol. 3), had nine branched rays in the dorsal fin preceded by an ossecus nondenticulated simple ray, together with large scales, upper and lower lips continuous, upper lip separated from the snout by a deep groove, lower lip medianly connected with the isthmus and markedly separated from the lower jaw, which is covered with a horny sheath, well-developed rostral and maxillary barbels, and preorbital and suborbital regions with horizontal rows of pores often surmounted by tubercles.

The genus *Poropuntius* was proposed by the writer (Smith, 1931a) for fishes similar to *Lissochilus* but with 8 branched dorsal rays and denticulated last simple dorsal ray. The limits of the genus *Lissochilus* were subsequently extended by de Beaufort, Myers, and others so as to include fishes with the characters of *Poropuntius.*

The name *Lissochilus* is unavailable for use in ichthyology because it was first employed by Zittel (Handbuch der Palaeontologie, 1882) for a genus of fossil mollusks. Of the possibly available names, *Acrossocheilus* is the most promising, although as originally defined it does not apply to any of the species, formerly placed in *Lissochilus*. known from India, Thailand, Malaya, and the Indo-Australian Archipelago. Its availability depends on the acceptance of the view that the various types of lower lip in this group (whether entire, slightly notched, or completely divided with the two halves moderately or widely separated) represent simply intergrading stages of the same structural feature.

These fishes inhabit mountain streams of India, Burma, Thailand, Indo-China, China, Malaya, and Sumatra. Seven local species herein recognized may be identified by the following characters:

1a. Dorsal fin with 8 branched rays; last simple dorsal ray denticulated; origin of dorsal fin anterior to, over, or slightly behind origin of ventrals.
  2a. Scales in lateral line 24 to 26; predorsal scales 8 or 9.
    3a. Depth 3.7 in standard length; scales in transverse series from midline of back to base of ventral fin 3.5–1–2.5; circumpeduncular scales 12; origin of dorsal fin somewhat in advance of ventrals; a black band from head to base of caudal fin; a dark submarginal stripe on each caudal lobe____vittatus
    3b. Depth 2.75 in standard length; scales in transverse series from midline of back to base of ventral fin 5.5–1–2.5; circumpeduncular scales 14; origin of dorsal fin directly over base of ventrals; each scale of back and sides with a green basal crescent; caudal lobes plain_____malcolmi
  2b. Scales in lateral line 29 to 38, scales in transverse series from midline of back to base of ventral fin 4.5 to 6.5–1–2.5 to 3; predorsal scales 11 to 14; circumpeduncular scales 14.
    4a. Scales in lateral line 29 to 33; least depth of caudal peduncle 1.5 times in its length; origin of dorsal fin over about tenth scale of lateral line; general color lustrous golden or bronze; each caudal lobe with a black marginal longitudinal stripe_______________________________ deauratus
    4b. Scales in lateral line 34 to 38; least depth of caudal peduncle 2 times in its length; origin of dorsal fin over about thirteenth scale of lateral line; general color silvery; caudal lobes plain___________ bantamensis
1b. Dorsal fin with 9 branched rays.
  5a. Last simple dorsal ray strongly denticulated; origin of dorsal fin over origin of ventrals; scales in lateral line 34, scales in transverse line from midline of back to base of ventral fin 5.5–1–2.5; predorsal scales 11; circumpeduncular scales 6_______________________________________ schroederi
  5b. Last simple dorsal ray nondenticulated; origin of dorsal fin before ventrals; scales in lateral line 23 to 29; scales in transverse line from midline of back to base of ventral fin 3.5–1–2 or 2.5; predorsal scales 7 to 9; circumpeduncular scales 12.
    6a. Scales in lateral line 23 to 25; predorsal scales 7 or 8; depth of body 3.1 to 3.2 in standard length; distal part of caudal lobes usually black.
sumatranus
    6b. Scales in lateral line 26 to 29; predorsal scales 8 or 9; depth of body 3.4 to 3.6 in standard length; caudal lobes without black markings__ dukai

ACROSSOCHEILUS VITTATUS, new species

FIGURE 33

Description.—Depth 3.7 times in standard length; least depth of caudal peduncle 1.4 in its length and 2.7 in head; head about 3.6 in length; eye 3.5 in head, slightly less than interorbital space and slightly greater than snout; two pairs of barbels, the maxillary ones about equal to eye and somewhat longer than the rostral ones; four or five irregular horizontal rows of tubercles extending from rostral barbel to a point under posterior margin of eye, front of snout without tubercles; gill rakers on first arch 3+0.

Squamation: Scales comparatively large; 24 in lateral line, 3.5–1–2.5 in transverse line from midline of back to base of ventral fin, 9 predorsal, 12 circumpeduncular.

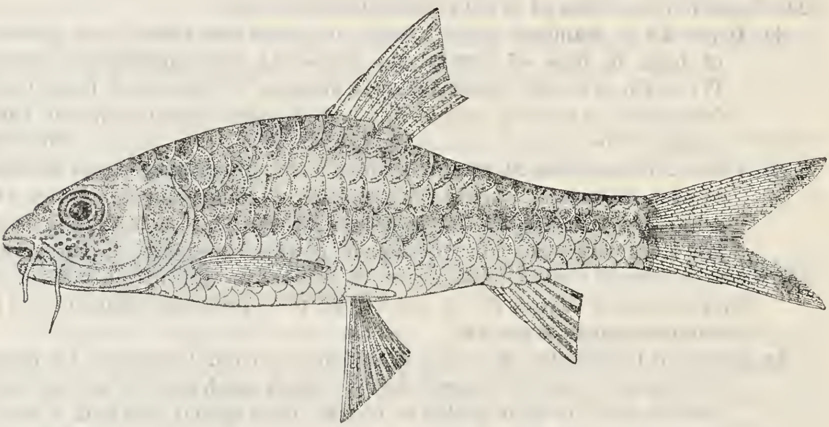


FIGURE 33.—*Acrossocheilus vittatus*, new species: Type (U.S.N.M. No. 117749). Drawn by Mrs. Alice C. Mullen.

Fins: Origin of dorsal fin definitely in advance of ventrals, over eighth scale of lateral line, midway between tip of snout and base of caudal fin; dorsal rays iii, 8; last simple ray weakly ossified, its length 1.3 in head; caudal fin shorter than head, deeply forked, the lobes pointed; anal rays ii, 8, the longest, the second simple ray, equal to ventral; ventral rays i, 8, extending to vent; pectoral rays i, 15, reaching base of ventrals, somewhat less than height of dorsal.

Coloration: Back and top of head light brown, some of the scales of the back with dark bases; a black band from head to base of caudal fin, involving lateral-line scales and one row above; underside of head and body pale yellow; membranes of dorsal fin with minute dark spots and lines; a submarginal longitudinal dark stripe on each caudal lobe; anal, ventral, and pectoral fins plain.

Type.—The type and only known specimen (U.S.N.M. No. 117749), 10 cm. long, was collected by H. G. Deignan October 18, 1936, in Huey Mekong Kha, a mountain brook tributary to the Salwin, at a point between Mesarieng and Ta Ta Fang, Western Thailand.

Remarks.—The combination of large scales with a black longitudinal band on the side of the body, serves to distinguish this species from other local forms and from other described species. From *A. sumatranus*, a species with similar squamation, the differences are in having one less branched dorsal ray and in coloration; from *A. deauratus*, the species with similar dorsal rays, the differences comprise fewer scales and peculiar coloration. The relations with the other local species are brought out in the key.

ACROSSOCHEILUS MALCOLMI, new species

FIGURE 34

Description.—Moderately elongate, rather strongly compressed; profile from snout to dorsal fin strongly arched; depth 2.75 in standard length; least depth of caudal peduncle 1.5 in its length and about 0.5 length of head; head 3.6 in standard length; snout 3.4 in head and 1.25 in the moderately convex interorbital space; eye equal to snout, mostly in anterior half of head; maxillary and rostral barbel subequal, about 0.75 diameter of eye; mouth small, slightly inferior, maxillary extending to anterior margin of eye; a few pores on side of snout; gill rakers on first arch 5+14, those on upper arm and on lower arm near angle short spinous filaments, those on lower arm becoming lower and blunter, and finally reduced to a mere ridge.

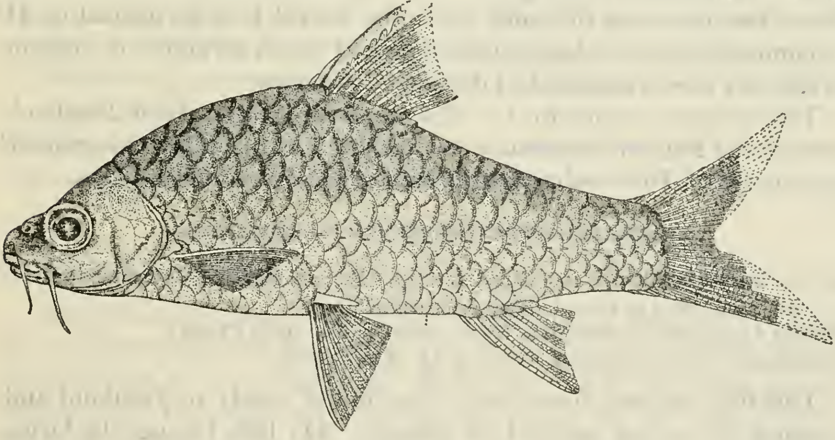


FIGURE 34.—*Acrossocheilus malcolmi*, new species: Type (U.S.N.M. No. 117748). Drawn by Mrs. Alice C. Mullen.

Squamation: Scales in lateral line 26, in transverse series to base of ventral fin 5.5–1–2.5, in predorsal region 8, around caudal peduncle 14; a scaly sheath at base of dorsal and anal fins.

Fins: Dorsal fin arising directly over base of ventrals, nearer to tip of snout than to base of caudal, over eighth scale of lateral line; dorsal rays iii,8, the last simple ray stout and strongly denticulated on its posterior side; caudal deeply forked, its lobes pointed, and longer than head; anal rays iii,5, the longest branched ray 1.3 in head; ventrals extending to anal opening, rays i,8; pectorals equal to and reaching base of ventrals, shorter than head, the rays i,16; ventral axillary scale less than 0.5 length of fin.

Coloration: Silvery; each scale of back and sides with a dull green basal crescent; fins plain.

Type.—The type (U.S.N.M. No. 117748), 13.3 cm. long, apparently a female, was collected in the Meping at Raheng, Central Thailand, in July 1924, by Dr. Malcolm Smith.

Remarks.—The comparatively deep body, rather large scales, position of the dorsal fin with reference to the ventrals, dorsal fin with 8 branched rays and a denticulated simple ray, together with the coloration, serve to differentiate this species. The nearest relative among the local members of the genus is *A. vittatus*, which has a slenderer form, two less rows of scales above the lateral line, 12 instead of 14 circumpeduncular scales, origin of dorsal fin in advance of, instead of directly over, ventrals, and different coloration.

This species is named for Dr. Malcolm Smith, formerly of Thailand, now of the British Museum, in appreciation of his efforts to promote knowledge of Thai zoology, especially of the fishes and reptiles.

ACROSSOCHEILUS DEAURATUS (Cuvier and Valenciennes)

Barbus deauratus CUVIER and VALENCIENNES, 1842, vol. 16, p. 188 (Cochinchina).—SAUVAGE, 1881, p. 183, pl. 6, fig. 5 (Cochinchina).
Barbus (*Lissochilus*) *deauratus* HORA, 1923b, p. 155 (Koh Chang).
Poropuntius normani SMITH, 1931a, p. 14 (Kao Sabap).

This fish has been found to be distributed widely in Thailand and common in various parts of the country. On Koh Chang, the large, mountainous, wooded island in the Gulf of Siam off Southeastern Thailand, this is the commonest fish in the upper parts of the several streams. Its favorite haunts are the clear, deep, rocky pools below waterfalls. Numerous specimens were collected during half a dozen years. Other localities from which specimens have come are streams on Kao Bantad, Province of Krat, Southeastern district; headwaters of the Menam Sak, Central area; and Huey Mekong Kha, a tributary of the Salwin west of Mesarieng, Western Thailand. In the Menam

Kon, an upper tributary of the Menam Nan, H. G. Deignan obtained a specimen 7.5 cm. long in April 1936, and just over the boundary from Nan Province, in French Laos, Mr. Deignan collected a good series in Huey Nam Puat, a mountain brook whose waters eventually reach the Mekong. In the gorge of the Mechem, in Northern Thailand, A. R. Buchanan and P. D. Harrisson obtained a series of specimens in July 1935; these are from 4.4 to 5.7 cm. long. All show rostral tubercles, and one is a male with well-developed gonads.

In the British Museum are many specimens collected in the Patani River, Peninsular Siam, by Annandale and Robinson. These were examined by the writer in December 1927.

Of the numerous specimens at hand, the largest is 18.6 cm. long.

When first taken from the water this fish had the back and sides like burnished bronze, the underparts white, all the fins green, and the caudal with a black longitudinal stripe in each lobe.

This species was inadequately described by Cuvier and Valenciennes in 1842 from Cochinchina under the name *Barbus deauratus*. No reference was made to the peculiar features of the lips and jaws and to the pores or tubercles on the rostral and suborbital regions, and the dorsal spine was described as slender and smooth. In 1881 Sauvage gave a fuller description from a specimen, 12.5 cm. long, from Cochinchina and he brought out the presence of large pores on the snout and of denticulations on the last simple dorsal ray.

The material now available indicates that the fish called *Poropuntius normani* is the present species.

A vernacular name for the fish has been recorded only on Koh Chang, where it is called *pla kayao*, a name shared by no other species.

ACROSSOCHEILUS BANTAMENSIS (Rendahl)

Barbus bantamensis RENDAHL, 1920, p. 1, fig. 1 (head) (Northern Siam).

The type, 13 cm. long without the caudal fin, was collected by Count Nils Gyldenstolpe at Ban Tam, apparently on the Meping, at the eastern base of Doi Chiengdao, Northern Thailand. Through the courtesy of Dr. Hjalmar Rendahl, of the Royal Natural History Museum in Stockholm, this specimen was sent to the U. S. National Museum for examination, and it is now possible to state that the fish falls within the limits of the present genus and is closely related to *A. deauratus*.

In the original description, the species was credited with six branched anal rays; the type specimen, however, has only five such rays, as in all other species of the genus. Other features disclosed by examination of the type are triserial uncinate teeth (2, 3, 5–5, 3, 2) and four very short spinus gill rakers on the lower arm of the first gill arch on each side.

Referred to this species are 21 specimens collected by Deignan September 2 and 4, 1935, in Meklang Pla, a tributary of the Meklong, on Doi Angka, Northern Thailand. These specimens range in size from 9.4 to 17.5 cm., the largest a male with strongly developed sharp tubercles on the snout; a female with large ovaries and also bearing large tubercles on the snout is 14.4 cm. long. In the important character of number of scales in the lateral line, these specimens are about equally divided into lots with 34, 35, 36, 37, and 38 scales, a greater number than in any of the numerous specimens of *A. deauratus* examined. Associated with this character is the possession by 16 of the 21 specimens of a greater number of predorsal scales than is found in *A. deauratus.* Other distinctive features in *A. bantamensis* are the relatively more slender caudal peduncle and the absence in the fully adult fish of the black longitudinal bands on the caudal lobes.

The scale characters in *A. bantamensis* compared with those in *A. deauratus* are brought out in the following table based on 21 specimens of the former and 39 specimens of the latter from five Siamese-Indo-Chinese localities, namely, Koh Chang, in the Gulf of Siam; the Mun River in Eastern Thailand, and Huey Nam Puat in Laos, both tributary to the Meklong; the Pasak River in Central area; and Huey Meklong Kha, a tributary of the Salwin in Western region.

Characters	Number of specimens of *Acrossocheilus bantamensis*	Number of specimens of *Acrossocheilus deauratus*
Scales in lateral line:		
29		3
30		6
31		16
32		11
33		3
34	5	
35	4	
36	4	
37	4	
38	4	
Scales in transverse line:		
4½-1-2½		3
5½-1-2½	18	32
5½-1-3	3	
6-1-2½		2
6-1-3		2
Scales in predorsal region:		
11		9
12	5	30
13	10	
14	6	

ACROSSOCHEILUS SCHROEDERI, new species

FIGURE 35

Description.—Moderately elongate and compressed; depth of body 3.4 in standard length; least depth of caudal peduncle 1.5 in its length, 1.9 in length of head; eye 3.5 in head, slightly less than snout and bony interorbital space; mouth small, slightly overhung by snout, its width at base about equal to diameter of eye; lips rather full, postlabial grooves of lower jaw approaching rather closely to each other and leaving an isthmus 0.3 diameter of eye; maxillary not extending beyond vertical from nostrils; barbels subequal, 1.5 times diameter of eye.

Squamation: Scales in lateral line 34; scales in transverse series from midline of back to base of ventral fin 5.5—1—3; predorsal scales 11; circumpeduncular scales 16.

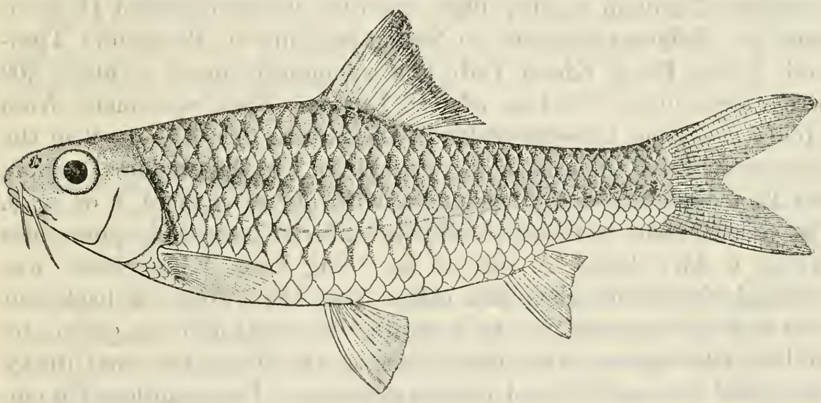


FIGURE 35.—*Acrossocheilus schroederi*, new species: Type. Drawn by Mrs. Aime M. Awl

Fins: Origin of dorsal fin over base of ventrals and nearer to tip of snout than to base of caudal fin; dorsal rays iii, 9; last simple dorsal ray rather short and coarsely denticulated, its length less than head; caudal fin forked for more than 0.5 its length, about as long as head; anal fin small, rays iii, 5, longest ray 0.5 head; ventral fins 1.7 in length of head, not reaching anal opening; pectoral rays i, 15, somewhat longer than ventrals.

Coloration (in alcohol): Plain; each scale of back and sides with a narrow black basal crescent; a narrow but well-defined black line from upper angle of gill opening to upper base of pectoral fin; outer part of dorsal rays and membranes blackish, giving the appearance of a black spot when fin is partly flexed; other fins plain.

Type.—The type, 11 cm. long, taken in the Mekang on Doi Angka, Northern Thailand, in April 1937, by the Harvard Primate Expedition, is in the collection of the Museum of Comparative Zoology. No other specimen is available.

Remarks.—This species may be distinguished from other known forms by the combination of a very small mouth, 34 scales in lateral line, 16 circumpeduncular scales, 9 branched rays in dorsal fin, and coloration.

The fish is named for William C. Schroeder, associate curator of fishes in the Museum of Comparative Zoology.

ACROSSOCHEILUS SUMATRANUS (Weber and de Beaufort)

Lissochilus sumatranus WEBER and DE BEAUFORT, 1916, vol. 3, p. 169, figs. 68, 69 (Bandar Baru, Sumatra).—SUVATTI, 1936, p. 55 (Sichon, Tadi, Trang, Nakon Sritamarat).

Lissochilus hutchinsoni FOWLER, 1934a, p. 120, figs. 76, 77 (Nakon Sritamarat).

Acrossocheilus hutchinsoni FOWLER, 1939, pp. 41, 70 (Huey Yang, Trang).

Otherwise known only from Sumatra, this species was ascertained to inhabit Thailand in July 1928, when the writer collected 11 specimens in 3 different localities in Nakon Sritamarat, Peninsular Thailand: Klong Pong, Klong Tadi, and a mountain brook at about 300 meters elevation on the base of Kao Luang. These specimens, from 5 to 14 cm. long, have 23 scales in the lateral line, 3.5—1—2 in the transverse line to the base of the ventral fin, 7 in the predorsal region, and 12 around the caudal peduncle, with dorsal rays iii, 9 or iv, 9. The general color is silvery, with the scales of back and upper sides having a dark base. A fish 14 cm. long from Klong Tadi was strikingly beautiful when just taken from the water, the back and sides rich silvery green, the belly white, the dorsal fin dark green, the caudal yellow-green, with black tips on the lobes, the anal dusky green, and the ventrals and pectorals orange. In examples of 6 cm. or larger there are tubercles on pores on the preorbital and suborbital areas; smaller fish usually lack the tubercles.

Thirteen additional specimens were taken in September 1929 in a mountain stream at Sichon, and in September 1933 below a waterfall on Kao Chong, near Trang, both these places in Nakon Sritamarat; in these the dorsal interradial membranes are black. In August 1934 one specimen 8.2 cm. long was collected in Huey Melao, on Doi Hua Mot, Northern Thailand.

Examples sent to Dr. L. F. de Beaufort were found by him to exhibit only minimal differences from fishes from Sumatra.

The fish described by Fowler (1934a), as *Lissochilus hutchinsoni* from Nakon Sritamarat is undoubtedly this species. Fowler's single specimen, 14.8 cm. long, agrees well with the description of *A. sumatranus* as regards proportions, squamation, and fin rays. The only points of difference mentioned by Fowler are the black ends of the caudal lobes, the uniform coloration, and the ventral fins nearly reaching anal fin in *A. sumatranus*, whereas in *L. hutchinsoni* the ends of the caudal lobes are not black, the scales of the back and sides have a narrow, dark basal crescent, and the ventrals extend about two-thirds of the distance to the anal fin. It may be pointed out, however, that the caudal lobes do not always have black ends in *A. sumatranus*, as Dr. de Beaufort stated in a letter and as specimens collected by the writer show; and the length of the ventrals in the Thai specimens at hand varies with sex and size. In the figure of *L. hutchinsoni* a large, round, sharply defined black spot on the middle of the anal fin is present. This is not observed in the specimens under consideration, but Fowler's description does not mention this feature and reads: "Anal whitish, membranes medially and anteriorly dusky to blackish." In a series of 17 specimens from a waterfall stream near Trang, Fowler (1939) found none with the large black blotch on the anal fin as shown in the figure.

Vernacular names given to this fish are *pla wurd* on Kao Chong, *pla hae* (probably a contraction of *kahae*) on Klong Tadi, *pla hai* at Sichon, and *pla chae* on Doi Hua Mot.

ACROSSOCHEILUS DUKAI (Day)

Barbus dukai Day, 1878, vol. 2, p. 564 (Darjeeling River, India).
Barbus (*Lissochilus*) *dukai* Hora, 1923b, p. 155 (Nakon Sritamarat mountains).
Lissochilus dukai Suvatti, 1936, p. 55 (Nakon Sritamarat).—Fowler, 1937, p. 188 (Mepoon).

With its wide distribution—India, Shan States of Burma, Malaya, and probably Sumatra—the presence of this fish in Thailand is not unexpected. Since the first specimens were recorded by Hora from mountains west of Nakon Sritamarat, the fish has been collected in various other mountain streams in the province of that name (southeast of Tung Song, at Klong Chawang east of Bandon, at Sichon, and at Kao Chong), in the Bajo waterfall stream in Patani, in Central Thailand at Mepoon, and in Huey Melao, on Doi Hua Mot, northern region. The specimen taken at Huey Melao, 15.5 cm. long, was taken August 23, 1934, at an elevation of 1,000 meters. Young specimens have a conspicuous black spot at the base of the caudal fin.

In Patani this fish is called *pla tung nga*. A local name in the Doi Hua Mot region is *pla pang chae*.

Genus BALANTIOCHEILOS Bleeker

Balantiocheilos Bleeker (261), Nat. Tijdschr. Nederl-Indië, vol. 20, p. 430. 1859–60. (Type, *Balantiocheilos melanopterus* Bleeker.)

BALANTIOCHEILOS MELANOPTERUS (Bleeker)

Barbus melanopterus BLEEKER, 1851 (26), p. 11 (Bandjermassing, Borneo).

Balantiocheilus melanopterus BLEEKER, 1865 (347), p. 35 (Siam).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 206, fig. 76 (Siam).—HORA, 1923b, p. 159 (Nontaburi).—FOWLER, 1934a, p. 127 (Chiengmai); 1937, p. 200, figs. 185, 186 (Bangkok, Kemarat).

Balantiochilus melanopterus BLEEKER, 1865 (356), p. 176 (Siam).

Puntius melanopterus SAUVAGE, 1881, p. 163 (Siam).

Outside of Thailand this species appears to be known only from Borneo, Sumatra, and Malaya. The species must, however, occur in Indo-China, as it is reported from Kemarat, on the Mekong, where it forms the boundary between Thailand and Cambodia.

This fish ranges throughout the basin of the Menam Chao Phya, being recorded from Bangkok to Paknampo, the Meping at Chiengmai, the lower Menam Nan and Bung Borapet, and the Menam Sak below the irrigation barrage at Dha Luang. Its principal center of abundance is the Paknampo region, where at times it is very numerous.

While a length of 35 cm. is reported for Borneo and Sumatra, the largest examples met with in Thailand have been about 20 cm.

B. melanopterus may be recognized readily by its peculiar horseshoe-shaped mouth, with a pocket behind the lower lip, and the jet-black distal parts of the dorsal, caudal, anal, and ventral fins.

The fish has the ability to leap high out of the water. A sheer jump of 2 meters was once observed in the lower Menam Nan.

The local vernacular names have reference to its striking coloration. Those heard in different parts of Central Thailand are *pla hang mai* (burnt-tail fish), *pla hang yio* or *iew*, and *pla nam lang hang dam*.

Genus SCAPHIODONICHTHYS Vinciguerra

Scaphiodonichthys VINCIGUERRA, Ann. Mus. Civ. Storia Nat. Genova, ser. 2, vol. 9, p. 285, 1889–90. (Type, *Scaphiodonichthys burmanicus* Vinciguerra.)

The genus *Scaphiodonichthys* is very close to the genus *Semiplotus* of Burma and India. The principal difference is in the number of branched dorsal rays, which in the present genus range from 9 to 12, while in *Semiplotus* the minimum number is 20. In a letter Dr. Sunder Lal Hora, of the Indian Museum in Calcutta, wrote:

> The nature of the mouth in *Semiplotus* and *Scaphiodonichthys* suggests their very close affinity. In fact, the latter is distinguished from the former by the possession of fewer rays in the dorsal fin. The Siamese form [*S. acanthopterus*] with increased number of branched rays [as compared with *S. burmanicus*] shows that *Semiplotus* may have given rise to forms with fewer rays. It is quite possible that there may be some other forms yet to be discovered with a number of branched rays intermediate between 12 and 20. When such forms are found, *Semiplotus* and *Scaphiodonichthys* will have to be regarded as congeneric, with possibly subgeneric rank.

The two known species may be distinguished as follows:

1*a*. Scales in lateral line 37 or 38; branched dorsal rays 9 or 10 ----- **burmanicus**
1*b*. Scales in lateral line 41 or 42; branched dorsal rays 11 or 12 --- **acanthopterus**

SCAPHIODONICHTHYS BURMANICUS Vinciguerra

Scaphiodonichthys burmanicus VINCIGUERRA, 1889–90, p. 285, pl. 11, fig. 11 (Burma).—SMITH, 1933a, p. 79 (in part) (Northern Siam).

This strongly marked species, which Dr. Vinciguerra described from lower Burma near the Thai border in 1890, seems to have remained unnoticed by others until the writer reported it from Thailand in 1933. Numerous specimens were obtained in Northwestern Thailand in December 1932 and January 1933 in the Mepai at and near Muang Pai, in the Mekong Noi north of Mehongsorn, and in a brook west of Mesarieng, all of these tributaries of the Salwin. Specimens in the Deignan collection are from the Huey Mekong Kha, at the foot of Doi Mekong Kha, between Mesarieng and the Salwin. The British Musem contains specimens collected by Major Stockley on the boundary between Thailand and Tenasserim.

In Thailand this fish is restricted to mountain streams in the western drainage into Burma. The species is separated from the form inhabiting the headwaters of the Meping and tributaries of the Mekong by high mountain ranges. This separation has permitted the development of certain differential features, which are pointed out in the account of the following species.

A length slightly in excess of 18 cm. is attained.

SCAPHIODONICHTHYS ACANTHOPTERUS (Fowler)

Scaphiodonichthys burmanicus SMITH, 1933a, p 79 (in part) (Northern Siam).—FOWLER, 1935a, p. 120 (Shan States and Northern Siam).

Scaphiodontopsis acanthopterus FOWLER, 1934a, p. 119, figs. 74, 75 (Shan States, Burma; Metang River, Chiengmai).

A critical examination of an ample series of specimens indicates that this species, known from the basins of the Meping in Thailand and the Mekong in Thailand and the Shan States of Burma, is distinct from *S. burmanicus* (q. v.), known from the basin of the Salwin in Thailand and Burma and from minor streams in Tenasserim. The differences, while not marked, are constant and involve the number of scales in the lateral line and the number of branched rays in the dorsal fin. Thus, in *S. acanthopterus* the lateral-line scales number 41 or 42 against 37 or 38 in *S. burmanicus*, and the branched dorsal rays are always 11 or 12 in the former species as against 9 or 10 in the latter. Further comparison of specimens may bring out other differences.

The largest specimens examined from Thai waters have been 21 to 22 cm. long.

Examples up to 6.5 to 7 cm. long show very distinct black vertical blotches or stripes irregularly distributed over the silvery side. In specimens 8 cm. long or more the black markings have usually completely disappeared. In adult males the snout is thickly beset with stout prickly tubercles; in adult females the tubercles are less developed, have a rounded top, and may not project above the surface. Full maturity is attained by males at a length of about 11 cm., and many males exhibit lines of pearl organs on the anal rays. Its brilliant silvery body, extremely wide transverse mouth, and strong, denticulated last simple ray make the fish easily recognizable.

Among the mountain people of Northern Thailand this fish is everywhere called *pla mum*, a name borne by no other species.

SCAPHOGNATHOPS, new generic name

Scaphognathops, new generic name to replace *Scaphognathus* H. M. Smith, preoccupied in reptiles (*Scaphognathus* Wagner, Sitz. Ber. Akad. München, vol. 1, pp. 519, 531, 1861).

Genotype.—Scaphognathus stejnegeri H. M. Smith.

SCAPHOGNATHOPS STEJNEGERI (H. M. Smith)

FIGURE 36

Scaphognathus stejnegeri SMITH, 1931a, p. 22, figs. 10, 11 (Mekong).

Of this strongly marked species only the type specimen is known. It is 22.5 cm. long and was taken in the Mekong, Eastern Thailand.

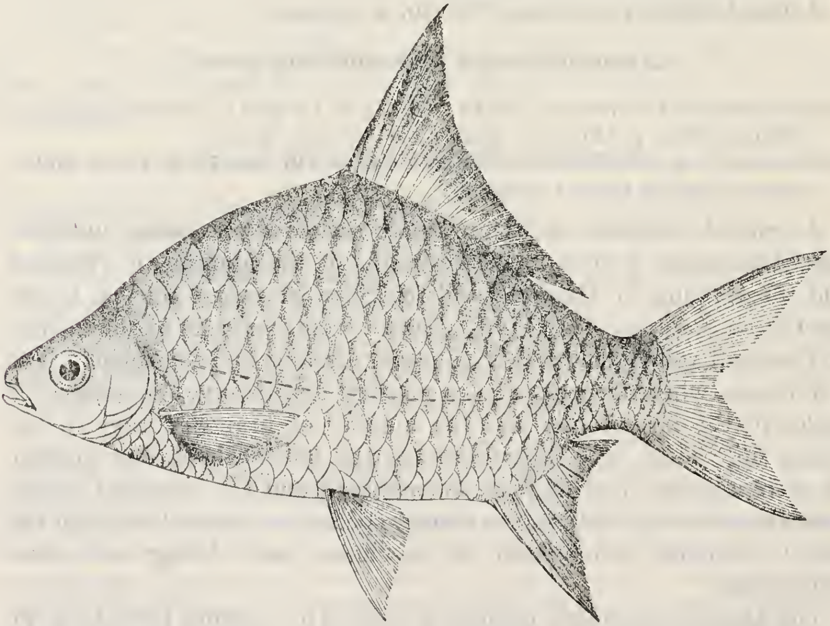


FIGURE 36.—*Scaphognathops stejnegeri* (H. M. Smith). Drawn by Luang Masya; courtesy of the Thailand Government.

February 24, 1929. It is apparently very rare. The outstanding characters are the deep, strongly compressed body; narrow scooplike lower jaw with lip confined to the sides; absence of barbels; branchial membranes broadly joined to the isthmus; pharyngeal teeth 5,3–3,5, the first 4 teeth in the first row blunt, molarlike, the last being much smaller and clavate, the teeth in the second row much smaller and clavate; gill rakers very short, conical, 10+4 on first arch; long, high dorsal fin with its last simple ray osseous and denticulated and its branched rays numbering 14; and anal fin with 6 branched rays and its last simple ray stout and osseous.

Genus THYNNICHTHYS Bleeker

Thynnichthys Bleeker (261), Nat. Tijdschr. Nederl.-Indië, vol. 20, p. 433, 1860. (Type, *Leuciscus thynnoides* Bleeker.)

THYNNICHTHYS THYNNOIDES (Bleeker)

Leuciscus thynnoides Bleeker, 1852 (67), p. 599 (Palembang, Sumatra).
Thynnichthys thynnoides Hora, 1923b, p. 154 (Nontaburi).
Thynnichthys thai Fowler, 1937, p. 177, figs. 114, 115 (Mepoon, Pitsanulok).

In the East Indian Archipelago this fish appears to be confined to Borneo and Sumatra. It is recorded also from Indo-China (Sauvage, 1881, p. 164), and was to be expected in the Malay States where Herre and Myers (1937) found it in Pahang and Perak. Its range in Thailand covers the entire length of the country from north to south. In the north, however, the fish is known only from the Mekok at Chiengrai; that is, it seems to be absent from the Meping and its tributaries. It has been taken in the Tale Sap, the Tale Noi, and the Patani River in the Peninsula. It does not seem to be present in the waters of Southeastern Thailand. At least, the collections therefrom have failed to yield it. The fish seems rare in the Eastern area; and the collection contains a single specimen, 5 cm. long, taken from the Menam Mun in November 1926. The great center of abundance is the basin of the Menam Chao Phya.

This fish may be recognized readily by its silvery sheen, minute scales, deficient upper lip, and tunnylike shape.

Adult fish are from 12 cm. long upward. A specimen with ripe eggs, taken in the Patani River on October 15, 1923, was 15.5 cm. long. The maximum size given by Weber and de Beaufort for Sumatra is 23 cm. The largest examples met with in Thailand were in a canal in Bangkok; many collected with a cast net May 3, 1923, were 25 cm. long.

Many of the fresh-water fishes in the lower reaches of the coastal rivers are very susceptible to a low degree of salinity of the water, which comes at the end of the dry season, and this species is no exception. Fish in a small pond in Tonburi, Bangkok, connected with the

Menam Chao Phya were killed on May 7, 1926, by the encroachment of brackish water from the river; 15 dead fish were picked up on the surface of the pond.

Fowler's *Thynnichthys thai* is clearly this species, agreeing perfectly therewith in proportions, fin formulae, scales in lateral and transverse series, etc. The only point of difference that Fowler mentions is the number of predorsal scales, given as 21 or 22 in *T. thai* and 30 in *T. thynnoides* on the authority of Weber and de Beaufort. These authors, however, say "about 30 irregular rows." As a matter of fact the predorsal scales are not easy to count, owing to their crowded, irregular arrangement, and different persons may obtain different figures for the same fish. Specimens in the U. S. National Museum show a range from 22 to 28.

In Thailand, fishermen, with their usual aptitude, call the fish *pla klet tee* (small-scale fish), a name that is almost everywhere in use. A variation on the Pasak River is *pla nang klet.* On some sections of the Menam Chao Phya the name *pla prom* is heard. At Patalung and on the Tale Sap in Peninsular Thailand the fish is called *pla ling.*

Genus OSTEOCHILUS Günther

Osteochilus GÜNTHER, Catalogue of the fishes in the British Museum, vol. 7, p. 40, 1868. (Type, *Osteochilus melanopleurus* (Günther)=*Rohita melanopleura* Bleeker.)

The osteochilids are common in the streams, canals, and lakes in most of Thailand, and in some places and at certain times may be abundant. All species form part of the local food consumption, and some are regularly sent to the larger markets.

Recognition of these fishes is effected easily by examination of the fringed lips, the broad confluence of the lower lip with the isthmus, the sharp bony edge of the lower jaw, and the long dorsal fin with 10 to 18 branched rays.

A basis for differentiation and classification adopted by Weber and de Beaufort is the presence or absence of large rostral pores, which may contain horny tubercles. In some species there are only three such pores, situated at the front of the snout; in other species there are two to four rows of pores on the front and sides of the snout; and in addition there may be minute pearl organs promiscuously disposed on head and body. In some species there is no vestige of pores at any stage of growth in any of the material at hand.

Fifteen species are recorded for Thailand:

1*a*. Maxillary and rostral barbels present.
  2*a*. Scales in lateral line 45 to 54.
    3*a*. Scales in lateral line 47 to 49; scales between midline of back and base of ventral fin 8.5–1–7; predorsal scales 15 or 16; circumpeduncular scales 20 to 24; 3 pores in a transverse row on front of snout; a large black blotch on caudal peduncle________________ borneensis

3*b*. Scales in lateral line 45 to 54; scales between midline of back and base of ventral fin 11 or 12–1–8; predorsal scales about 20; circumpeduncular scales 24 or 26; no pores on front of snout; a large black transverse blotch on the side anteriorly ---------- melanopleura

2*b*. Scales in lateral line 29 to 36.

4*a*. Circumpeduncular scales 14.

5*a*. No large pores or tubercles on front of snout; branched dorsal rays 12; scales in lateral line 35 or 36; scales between midline of back and lateral line 6.5 or 7; a black longitudinal band from head to base of caudal fin, thence extended to tip of median caudal rays ---------- waandersii

5*b*. Three large pores on snout; branched dorsal rays 12; scales in lateral line 31; scales between midline of back and lateral line 6; each scale of back and side with a black basal spot; body with a black longitudinal band most distinct posteriorly; a black bar on body along upper edge of gill opening ---------- scapularis

4*b*. Circumpeduncular scales 16.

6*a*. No pores on snout.

7*a*. Branched dorsal rays 12 to 18; scales in lateral line 33 to 36; depth contained 3 times or less in standard length; least depth of caudal peduncle about equal to its length; each scale of back and side with a black spot forming longitudinal lines; a round black spot on caudal peduncle ---------- hasseltii

7*b*. Branched dorsal rays 14 to 16; scales in lateral line 29 to 33; depth contained 3 times or less in standard length; least depth of caudal peduncle two-thirds its length; each scale of back and side with a yellow, orange, or red spot forming longitudinal lines; a round black spot on caudal peduncle ---------- duostigma

6*b*. Pores on snout.

8*a*. Front of snout with a large central pore and a smaller pore on each side in a horizontal row; a black band along lateral line from head to caudal fin or to tip of middle caudal rays ---------- vittatus

8*b*. Front of snout with 2 or 3 irregular horizontal rows of pores; no black longitudinal band; a black crescentic spot at fifth scale of lateral line and scale immediately above and below ---------- lini

4*c*. Circumpeduncular scales 20; no pores on snout ---------- schlegeli

1*b*. Only maxillary barbels present; pores on snout in several rows.

9*a*. Scales in lateral line 35; scales from midline of back to base of ventral fin 8–1–5; predorsal scales 11; gill rakers on lower arm of first arch about 38; branched dorsal rays 13 ---------- tatumi

9*b*. Scales in lateral line 40; scales from midline of back to base of ventral fin 8–1–5; pedorsal scales 11; gill rakers on lower arm of first arch about 38; branched dorsal rays 13 ---------- ochrus

1*c*. Only rostral barbels present.

10*a*. No pores on snout; lips entire; gill rakers on lower arm of first arch about 50; last simple dorsal ray greatly elongated, 3 in standard body length ---------- macrosemion

10*b*. Pores on snout in 2 horizontal rows; gill rakers on lower arm of first arch about 30 to 44; last simple dorsal ray not especially elongated.

11*a*. Predorsal scales 10 to 12; lips entire; gill rakers about 44; branched dorsal rays 15 ---------- spilopleura

11*b*. Predorsal scales 13 or 14; lips papillate; gill rakers about 30; branched dorsal rays 11 or 12 ---------- prosemion

1*d*. Position uncertain ---------- simus

OSTEOCHILUS BORNEENSIS (Bleeker)

Rohita borneensis Bleeker, 1857 (162), p. 17 (Borneo); 1859–60 (239), p. 102 (Siam [after Castelnau]).

Rohita (*Rohita*) *borneensis* Bleeker, 1865 (356), p. 175 (Siam).

Osteochilus borneensis Weber and de Beaufort, 1916, vol. 3, p. 126 (Siam [after Bleeker]).

This species was identified by Bleeker from a drawing by Castelnau contained in an album of Thai fishes. No collection in Thailand has yielded this fish. One may suggest that the drawing was inaccurate, that it was not based on a Thai specimen, or that Bleeker misidentified it. Several species represented in Castelnau's drawings as listed by Bleeker were certainly not Thai: one of them was *Acanthobrama simoni* from China and another was *Pseudoxiphophorus bimaculatus* (Heckel) from Mexico. In view of the occurrence in Thailand of many Bornean species, the finding of *O. borneensis* in Thailand is not impossible, and it is retained in this catalog in view of that contingency.

OSTEOCHILUS MELANOPLEURA (Bleeker)

Rohita melanopleura Bleeker, 1852 (55), p. 430 (Bandjermassing, Borneo; Palembang, Sumatra).

Rohita (*Rohita*) *melanopleura* Bleeker, 1865 (356), p. 175 (Siam).

Osteochilus melanopleurus von Martens, 1876, p. 401 (Bangkok).—Sauvage, 1881, p. 163 (Bangkok); 1883b, p. 152 (Menam Chao Phya).—Fowler, 1934a, p. 116 (Bangkok); 1934b, p. 343 (Bangkok); 1935a, p. 115 (Bangkok); 1937, p. 179 (Bangkok).

Osteochilus melanopleura Weber and de Beaufort, 1916, vol. 3, p. 127 (Siam).—Hora, 1923b, p. 154 (Bangkok, Nontaburi).—Vipulya, 1923, p. 226 (Bangkok).

From Borneo and Sumatra, the range of this fish extends to the Malay States and Peninsular Thailand, Central region, and Eastern area, but there are no available records for the mountain regions of Northern and Western Thailand. Specimens have been examined from the Tale Noi, the Tapi River near Bandon, the Meklong, throughout the Menam Chao Phya, the Mewang at Lampang, and the Menam Mun east of Korat.

This is the largest of the local species of *Osteochilus*. A length of 37 cm. is assigned for the East Indies. In Thailand, examples 27 to 30 cm. long are frequently met with; a specimen of 38 cm. was taken in the east branch of the Kanburi River in September 1928 and fish fully 40 cm. long have been observed.

The fish is easily recognizable by its abruptly ascending mouth, fringed lips, long dorsal fin, generally grayish-green color of body, with numerous irregularly disposed small silvery spots and a large blackish transverse blotch on the anterior part of the body.

Anglers using dough, prawns, and insects as bait catch this fish in the Menam Chao Phya and other large rivers.

Throughout its range in Thailand the fish bears the vernacular name of *pla prom* or *pla prom hua men*, the last two words meaning smelly head.

OSTEOCHILUS WAANDERSII (Bleeker)

Rohita waandersii BLEEKER, 1852 (70), p. 733 (Toboali Province, Banka.)
Osteochilus waandersi BOULENGER, 1903, p. 303 (Patani River).

The only Thailand record for this fish of Sumatra and Bangka is that of Boulenger, who found the species represented by a half-grown specimen in a collection made by Annandale and Robinson in the Patani River, between Biserat and the town of Patani. The differential characters are absence of pores or tubercles on the snout, 6.5 or 7 series of scales between the midline of the back and the lateral line, 7 series of scales below the lateral line, 12 branched rays in the dorsal fin, and a black band from the head to the tips of the median caudal rays. There is a strong resemblance to *O. vittatus*, in which there is always a large median rostral pore or horny tubercle with a smaller one on either side, the three being in a straight horizontal row. A length of about 20 cm. is attained.

OSTEOCHILUS SCAPULARIS Fowler

Osteochilus scapularis FOWLER, 1939, p. 69, figs. 17, 18 (Trang).

Known from a single specimen, 13.8 cm. long, from a waterfall stream near Trang in Peninsular Thailand, this species has a combination of features by which it may be distinguished from related forms: Rather deep body (depth 2.8), large head (3.5 in standard length), two pairs of barbels, 31 scales in the lateral line, 6–1–5 scales in transverse series to base of ventral fin, 10 predorsal scales, 14 circumpeduncular scales, 44 short gill rakers, 12 branched rays in the dorsal fin, a blackish longitudinal band most distinct on the posterior half of the body and extending on the base of the central caudal rays, a black bar on the body along the upper edge of the gill opening, each scale of the back and sides with a black basal spot, and all fins reddish. The lips are described as "broad, thin, edged all around with row of papillae, inner surfaces strongly striate, outer less so, medial and symphyseal region well papillated or fringed," and the coriaceous mandible has "5 cutaneous folds each side." The description makes no mention of rostral pores, but the figure indicates 3 large pores at the front of the snout.

The species is rather close to *O. vittatus*, with which it agrees in squamation, rostral pores, fin rays, and falcate vertical fins. Differences are in body proportions, in fewer circumpeduncular scales, in origin of the anal fin under the last rays of the dorsal fin (anal arising far behind the dorsal fin in *O. vittatus*), in the more complicated lips, and in coloration.

OSTEOCHILUS HASSELTII (Cuvier and Valenciennes)

FIGURE 37

Rohita hasseltii CUVIER and VALENCIENNES, 1842, vol. 16, p. 274 (locality not given).

Rohita (Rohita) hasselti BLEEKER, 1865 (347), p. 35 (Siam).

Rohita (Rohita) hasseltii BLEEKER, 1865 (356), p. 175 (Siam).

Osteochilus hasseltii SAUVAGE, 1883b, p. 152 (Menam Chao Phya).—FOWLER, 1934a, p. 115 (Chiengmai, Chantabun); 1935a, p. 115 (Bangkok); 1939, pp. 41, 45 (Huey Yang and Krabi).

Osteochilus hasselti WEBER and DE BEAUFORT, 1916, vol. 3, p. 135 (Siam).—HORA, 1924a, p. 470 (Tale Sap).

One of the commonest and most widely distributed osteochilids in the rivers and lakes of the large islands of the East Indies (Java, Borneo, and Sumatra), this fish occurs also in Jahore, Malacca, Pahang, and other Malay States, and it is found throughout the length and breadth of Thailand with the exception of the waters of the Mekong drainage and of the Bay of Bengal watershed, from which no specimens have as yet been reported. Inasmuch as the writer found the fish very abundant in the Seamreap River, Cambodia, an affluent of the Tonle Sap, it undoubtedly occurs in the Mekong and will eventually be reported from the Thialand side of that great boundary river. Definite records for Peninsular Thialand are the Patani River, Bajo waterfall, and Bukit in Patani Province; the inner lake of Tale Sap and various streams in Nakon Sritamarat; and the Tapi River near Bandon. In the Central area the fish is known from the Mekling, Menam Chao Phya, and other streams, and Bung Borapet. The fish as been taken in the Meping at Chiengmai in Northern Thialand,

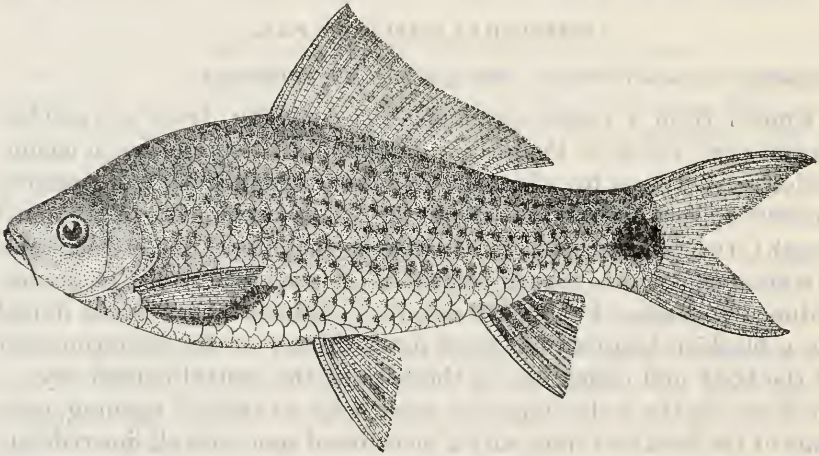


FIGURE 37.—*Osteochilus hasseltii* (Cuvier and Valenciennes). Drawn by Luang Masya; courtesy of the Thailand Government.

and from the Chantabun and Krat Rivers in the Southeastern region. From all of these waters specimens have been examined.

A length in excess of 30 cm. is attained, but in Thailand examples as large as 25 cm. are rare and the usual length of fully mature fish is from 15 to 20 cm.

The species is strikingly colored. In life the back may be rich green, the sides creamy, the belly white, with six to eight longitudinal lines of black spots following the rows of scales, a spot on each scale, the black lines sometimes extending to the ventral fins; the caudal, anal, and ventral fins are red, the dorsal is pale yellow or red, and the pectorals are white or greenish.

Throughout its range this fish is esteemed as food, meeting with ready sale at good prices.

Several distinctive colloquial names are given to *O. hasseltii.* In most parts of Central Thailand, as well as in Southeastern Thailand, it is known as *pla soi khao*, in fancied resemblance to a dove (*Streptopelia*) called *nok khao*, which has an area of small black and white spots on each side of the neck; this name is frequently shortened to *pla nok khao.* Throughout Peninsular Thailand the name in common use is *pla khi khom* (bitter-dregs fish), but in several places, as at the Bajo waterfall in Patani Province, the name *pla tu bo* is applied; *pla tu* is the extremely abundant and commercially important little mackerel of the Gulf of Siam, and *bo* is the bo tree, associated with the Buddha.

OSTEOCHILUS DUOSTIGMA Fowler

Osteochilus duostigma FOWLER, 1937, p. 182, figs. 120, 121 (Kemarat, Bangkok); 1939, p. 41 (Huey Yang).

This species, described from the Meklong, with paratypes from the Menam Chao Phya, resembles *O. hasseltii* in squamation, absence of pores on snout, barbels, fins, large black spot on caudal peduncle, and longitudinal lines of small spots following the rows of scales, and differs therefrom only in having a small cluster of black spots above the pectoral fin, two spots being on the fourth scale of the lateral line, and one spot on the scale above and one spot on the scale below No descriptions of *O. hasseltii* refer to these spots.

Four specimens 7 to 8 cm. long were caught with a dip net along the bank of the Menam Chao Phya near Nakon Sawan, Central Thailand, January 5, 1925. In these the minute pearl organs, in addition to thickly besetting the top of the head, occur on practically every scale, even the most posterior scales on the caudal peduncle. The round black spot on the caudal peduncle, larger than the eye, is sharply defined, as are the black spots anteriorly on the lateral line and the lines of dark spots following the rows of scales.

A specimen, 9.2 cm. long, taken April 29, 1927, in Pliew waterfall stream on Kao Sabap, Southeastern Thailand, agrees with the description and figures of this species and does not fit into the account of any other species.

OSTEOCHILUS VITTATUS (Cuvier and Valenciennes)

PLATE 6

Rohita vittata CUVIER and VALENCIENNES, 1842, vol. 16, p. 267 (Java).
Osteochilus vittatus FOWLER, 1934a, p. 116, figs. 68–73 (Chiengsen, Chiengmai); 1935b, p. 510 (Old Chiengsen); 1937, p. 180, figs. 122, 123 (Bangkok, Kemarat); 1939, pp. 39, 69 (Khao Bhanam Bencha, Trang).

This species abounds in rivers and lakes in Java, Borneo, Sumatra, and the Malay States, and in Thailand it is one of the commonest and most widely distributed members of the genus *Osteochilus*. It has been found in all parts of the country except the western drainage, and it is particularly numerous in the basin of the Menam Chao Phya. which river it regularly descends as far as Paknam.

A length in excess of 20 cm. is normally attained. The largest local specimen actually measured was 23.5 cm. long, from the Pran River May 29, 1928; this was a female, with ripe eggs. Full maturity, however, is attained at a much smaller size. Thus, a number of fishes under 6 cm. long taken in Borapet Swamp in November 1923 were females with large ovaries.

This is a strikingly marked species. The adults have a broad black band from the eye to the caudal fin, and usually the black band extends to the posterior end of the middle caudal rays. In some examples the back may be dark purplish or purplish black, and the lateral band then stands out less prominently.

Among the vernacular names borne by this fish is *pla rong mai tab* in common use in the Nakon Sritamarat province. In Southeastern Thailand the fish is called *pla kang lai.*

OSTEOCHILUS LINI Fowler

Osteochilus lini FOWLER, 1935a, p. 118, figs. 54, 55 (Khao Nam Poo).

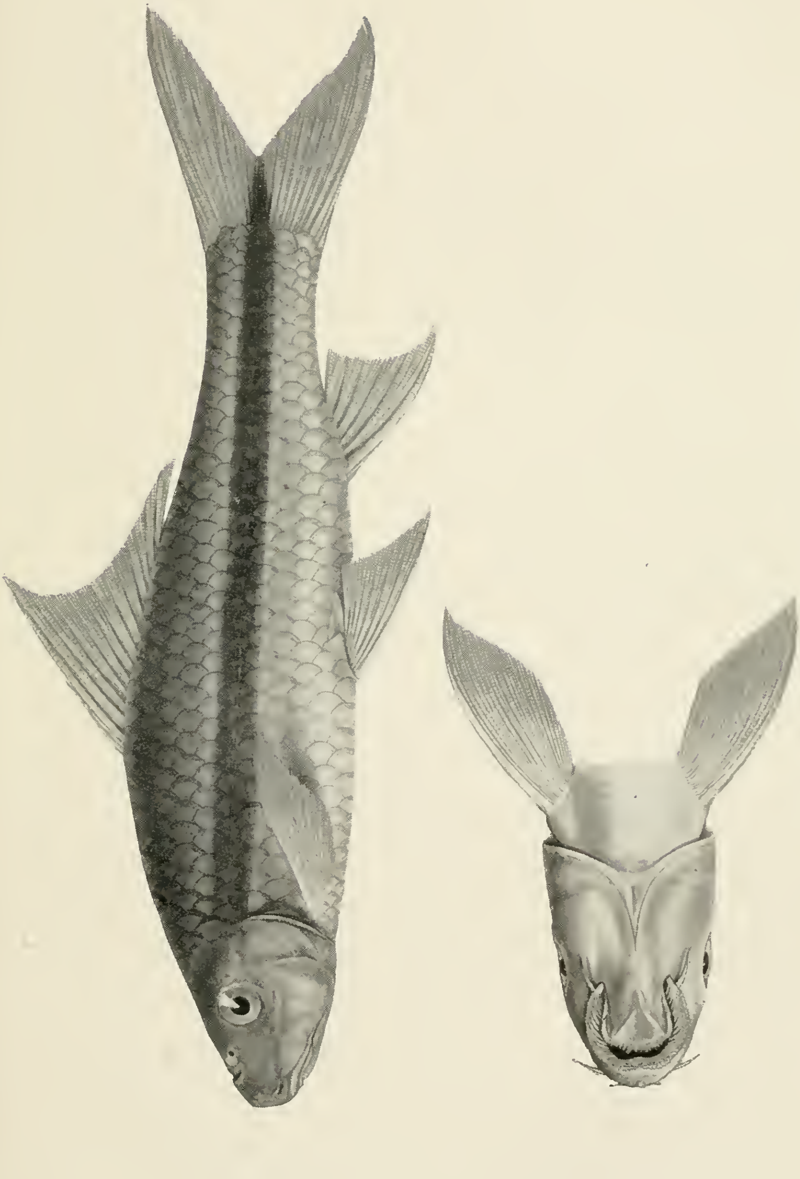
The principal features of this species, 6.5 to 8.4 cm. long, known from numerous specimens from Khao Nam Poo in northern Central Thailand are the fringed lips, 2 pairs of barbels, 2 or 3 irregular rows of pores on the front of the snout, 33 or 34 scales in the lateral line. and a black blotch on both sides of the lateral line above the pectoral fin.

OSTEOCHILUS SCHLEGELI (Bleeker)

FIGURE 38

Rohita schlegeli BLEEKER, 1851 (49), p. 432 (Bandjermassing, Borneo).
Rohita (*Rohita*) *schlegeli* BLEEKER, 1865 (356), p. 174 (Siam).
Osteochilus schlegelii SAUVAGE, 1881, p. 163 (Siam); 1883b, p. 152 (Menam Chao Phya).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 129 (Siam).

The range of this fish includes Borneo and Sumatra as well as Thailand. In the Thai rivers the fish is neither widely distributed



OSTEOCHILUS VITTATUS (CUVIER AND VALENCIENNES)

nor abundant. Definite locality records are for the Menam Chao Phya and the Meklong. The British Museum contains several specimens from the Menam Chao Phya received from the Siamese Museum. One of a lot collected at Angtong, on the Menam Chao Phya, in November 1923, was compared with Bleekerian material by Dr. de Beaufort and found to agree.

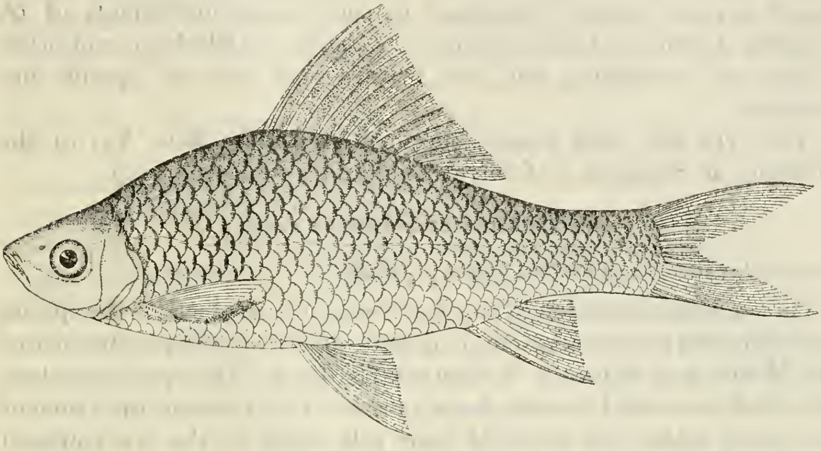


FIGURE 38.—*Osteochilus schlegeli* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

A fish, 15 cm. long, from the Meklong at Ban Pong, in December 1925, had 18 scales around the narrowest part of the caudal peduncle; the normal number is 20.

OSTEOCHILUS TATUMI Fowler

Osteochilus tatumi FOWLER, 1937, p. 180, figs. 118, 119 (Bangkok).

Only the type, 11.7 cm. long, from the Menam Chao Phya at Bangkok, is known. The species is described as having only a maxillary barbel, in this respect agreeing with *O. ochrus*. The barbel is 0.4 diameter of eye and does not appear in the figure of the whole fish but shows in the view of the underside of the head. There are "at least 4 series of pores on the snout, evidently scars of pearl organs," to quote the original description; in the figure three rows are represented on the snout and one row, of about six pores, on the upper lip.

OSTEOCHILUS OCHRUS Fowler

Osteochilus ochrus FOWLER, 1935a, p. 118, figs. 56, 57 (Bangkok); 1937, p. 180 (Kemarat).

The species is peculiar in having only maxillary barbels, which are very short and nearly concealed in the supralabial groove. The snout is described as having "3 or 4 irregular close-set pearl organ scars," but the figure shows over 30 such scars on one side of the head.

OSTEOCHILUS MACROSEMION Fowler

Osteochilus macrosemion Fowler, 1935a, p. 116 (Srisawat).

This species is regarded by Fowler as "apparently distinct" from *O. spilopleura*, having no pores on the snout and a prolonged third simple ray of the dorsal fin, which when depressed reaches nearly to the end of the last branched ray. There is a tendency of the anterior dorsal rays to become elongated in some large individuals of *O. vittatus* (Cuvier and Valenciennes), *O. triporus* (Bleeker), and other species of *Osteochilus*, and this feature may have no specific importance.

The type and only known specimen, from the Kwe Yai of the Meklong at Srisawat in Central Thailand, is 18.5 cm. long.

OSTEOCHILUS SPILOPLEURA Fowler

Osteochilus spilopleura Fowler, 1935a, p. 115, figs. 52, 53 (Srisawat).

Only a single specimen of this fish was known at the time the species was described; it was 21.3 cm. long and came from the east branch of the Meklong at Srisawat in Central Thailand. The species is characterized by rostral barbels, large pores in two rows on the front of the snout, entire lips, about 44 short gill rakers on the lower arm of the first arch, and a black blotch at the fifth and sixth scales of the lateral line extending partly above but mostly below the line.

A specimen in hand 17.7 cm. long was collected by Phya Daruphan Pithaks, chief conservator of forests, from the Mesoi, a tributary of the Mewang, north of Lampang; it agrees fairly well with the description of the type. All the scales of the back and side have a dark basal spot. The circumpeduncular scales, not mentioned in the original description, number 20.

The collector gave the local vernacular name for the fish as *pla pik deng*.

OSTEOCHILUS PROSEMION Fowler

Osteochilus prosemion Fowler, 1934a, p. 116, figs. 66, 67 (Chiengmai); 1937, p. 183 (Kemarat).

This fish is known from 4 specimens, 10.6 to 14.8 cm. long, from the Meping at Chiengmai and the Mekong at Kemarat.

Resemblance to *O. spilopleura* is seen in the presence of only rostral barbels, 2 rows of large pores on the front of the snout, and a black blotch across the lateral line above the pectoral fin. The principal differences are entire instead of papillate lips, less numerous gill rakers (about 30 as against 44), fewer predorsal scales, and 3 or 4 fewer branched rays in the dorsal fin.

OSTEOCHILUS SIMUS (Sauvage)

Rohita sima SAUVAGE, 1878b, p. 238 (Mekong, Indo-China); 1881, p. 177 (Mekong, Indo-China).
? *Osteochilus sima* FOWLER, 1935a, p. 117 (Srisawat).

The original description of this species from Pnom-Penh, on the Mekong in Cambodia, differs considerably from that of 3 years later. Thus, the fish was first credited with strongly fringed lips, 2 pairs of barbels, 48 scales in the lateral line, and dorsal rays 19 (including simple rays). With additional material, also from the Mekong, Sauvage reported the species as having an entire upper lip and fringed lower lip, only rostral barbels, 38 scales in the lateral line, and 17 dorsal rays. These differences can hardly be reconciled, and doubt must exist as to the real peculiarities of the species. The fish remained unnoticed until 1935 when Fowler gave a description of two specimens, 16.1 and 18 cm. long, from Srisawat, Central Thailand; these specimens, however, differ in essential features from one or both of the descriptions of Sauvage, having the upper lip entire and the lower lip papillate but not fringed, a single pair of barbels (rostral), 36 scales in the lateral line, 7 scales between the lateral line and the base of the ventrals (as against 5 or 5.5 scales according to Sauvage), end of snout with 2 horizontal rows of pores (as against 2 or 4 large pores in some specimens according to Sauvage), and dorsal fin with 5 simple and 15 branched rays. A further difference is that whereas the Thai specimens have the back and side olive, with a dark basal spot on each scale, and a conspicuous blackish crescent on the side above the pectoral fin, Sauvage assigns to his fish a brilliant, uniform coloration.

Determination of the true status of *O. simus* and of the Thai material so identified must await comparison with Sauvage's specimens if they are still existent.

Genus ACANTHORHODEUS Bleeker

Acanthorhodeus BLEEKER (411), Versl. Meded. Akad. Wet. Amsterdam, ser. 2, vol. 4, p. 252, 1870. (Type, *Acanthorhodeus macropterus* Bleeker.)

ACANTHORHODEUS DEIGNANI, new species

FIGURE 39

Description.—Dorsal outline a regular curve from snout to caudal peduncle; ventral profile somewhat more strongly arched; depth 2.4 in standard length; least depth of caudal peduncle equals its length and 1.5 in head; head 4.2 in length; eye 2.5 in head and 1 in interorbital space; snout less than eye; mouth very small, subterminal, maxillary extending about 0.5 distance between tip of snout and eye; a small maxillary barbel.

Squamation: Lateral line slightly decurved, running to lower half of caudal peduncle; scales in lateral line 35, in transverse series to base of ventrals 6–1–5, in predorsal region 15, surrounding narrowest part of caudal peduncle 14.

Fins: Origin of dorsal fin slightly posterior to ventrals, over the twelfth scale of the lateral line, about midway between tip of snout and base of caudal fin; dorsal rays ii, 11, second unbranched ray stiff and stout, first branched ray shorter than head; caudal well forked, longer than head; anal rays ii, 11, second simple ray stiff, first branched ray 1.5 in head; ventrals 1.5 in head; pectorals slightly longer than ventrals.

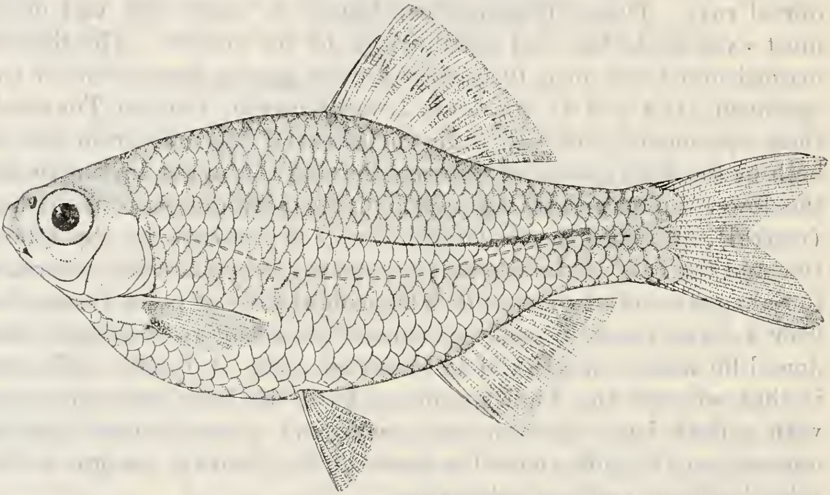


Figure 39.—*Acanthorhodeus deignani*, new species: Paratype (U.S.N.M. No. 107892). Drawn by Mrs. Amie M. Awl.

Coloration (in preservative): A light band about two scales in width extending from head to caudal base; in this band posteriorly a narrow blackish stripe beginning over anal and continuing nearly to base of caudal fin; fins plain, but with faint indications of dark spots on the dorsal and anal rays.

Type and paratypes.—A specimen 6.4 cm. long (U.S.N.M. No. 107938), the type, was collected by H. G. Deignan April 26, 1936, in Huey Nam Puat, a tributary of the Mekon, at Ban Nam Puat, French Laos. Paratypes are U.S.N.M. Nos. 107892, 107893.

Other specimens.—Taken at the same place and time were three other specimens 4.3, 5.5, and 6.2 cm. long, in which the dorsal rays were ii, 12 and the anal rays ii, 11.

Remarks.—This species has been compared with specimens of *A. asmussi* (Dybowski) from Siberia and China in the U. S. National Museum and with specimens of *A. guichenoti* Bleeker and *A. tonkinensis* Vaillant from China lent by the American Museum of Natural

History. From the first-named species a difference of cardinal importance is in the number of branched dorsal rays (16 to 18 in *A. asmussi*, 11 or 12 in *A. deignani*). Although Dybowski credited no barbels to his form, specimens in the National Museum otherwise agreeing very closely with *A. asmussi* and coming from the same waters as Dybowski's material have a small but distinct maxillary barbel. Similarly, *A. guichenoti* has 16 to 18 branched dorsal rays and other points of difference.

Of the various species of *Acanthorhodeus* recorded from Indochina and Siberia, the present form appears to be closest to Vaillant's imperfectly described species *A. tonkinensis* from the river Noi in upper Tonkin, which is known also from Hainan. In that form, however, the dorsal rays were given as iii, 15; and in a specimen about 8.9 cm. long from Hainan the branched dorsal rays number 15, although Nichols and Pope (1927) give the rays as 13 to 15 specimens from that island. Other differences shown by the Chinese form are the dorsal profile more arched than the ventral, the nuchal concavity, and the extension of the ventral fins on the anal.

Named for H. G. Deignan, who collected these first representatives of the genus *Acanthorhodeus* found west of the Mekong.

Genus LABIOBARBUS van Hasselt

Labiobarbus VAN HASSELT, Alg. Konst. Letterbode, vol. 2, p. 132, 1823. (Type, *Labiobarbus leptocheilus* van Hasselt.)

The fishes of this genus have for about a hundred years been referred to the genus *Dangila* Cuvier and Valenciennes (1842). An earlier name, *Labiobarbus*, which has been generally overlooked or ignored, was given by van Hasselt in 1823, with two Javan species, *leptocheilus* and *lipocheilus*, mentioned thereunder. These two names, adopted by Cuvier and Valenciennes, are acknowledged to be those of van Hasselt. The genotype of *Dangila* was fixed by Bleeker in 1863 as *leptocheilus*. The generic name *Labeobarbus* of Rüppell (1836), which has usually been applied to cyprinoid fishes of an entirely different kind, was thus a synonym of *Labiobarbus* van Hasselt and was otherwise unavailable, having been antedated by *Tor* of Gray.

These fishes are common in the rivers of Thailand and are recognized easily as to genus by the extremely long dorsal fin, which in local species has from 21 to 27 branched rays, combined with fringed upper lip, lips continuous at the corners of the mouth, sharp edge of the lower jaw, well-developed rostral and maxillary barbels, and small scales. Some of the species are very similar to each other, and are separated by a combination of minor features rather than by outstanding single characters.

A length of 30 cm. is rarely exceeded.

While the various species enter into commerce, none of them has a noteworthy food value.

The general vernacular name is *pla sa*. According to some information from Thai sources, *sa* may be an onomatopoeic name, representing the sound made by the fish when they come to the surface and take in and blow out water and bubbles as a part of their respiratory function.

Seven species are known in the fauna of Thailand:

1a. Circumpeduncular scales 16.
  2a. Head small, 5.5 in standard length; maxillary barbel equal to eye; pores on snout not described; longest dorsal ray less than depth of body; pectoral fins as long as head; body with dark longitudinal streaks following rows of scales---------------------------------- burmanicus
  2b. Head larger, 4.4 to 4.5 in standard length.
    3a. Maxillary barbel much longer than eye; numerous small pores or tubercles on pores on front of snout; longest dorsal ray equal to depth of body; pectoral fins longer than head; a dark band along side of body; a dark band along middle of back---------------------- sumatranus
    3b. Maxillary barbel equal to or shorter than eye; 2 transverse rows of large pores or tubercles on pores on front of snout; longest dorsal ray much less than depth of body; pectoral fins as long as head; body with 6 to 9 black stripes following lines of scales; no dark median dorsal band -- lineatus
1b. Circumpeduncular scales 20; scales in lateral line 43 to 45; scales in transverse line to base of ventral fin 7.5 or 8–1–5 or 5.5; maxillary barbel longer than eye.
  4a. Several rows of large pores on front of snout; pectoral fin shorter than head; a black diamond-shaped spot on side over middle of pectoral fin, center of spot uncolored; a large round black spot on caudal peduncle--- spilopleura
  4b. A single row of pores on front of snout; pectoral fin as long as head; a black spot on each scale of back and side forming interrupted longitudinal lines; no mark on side over pectoral fin; a round black spot on caudal peduncle-- siamensis
1c. Circumpeduncular scales 18 to 22; scales in lateral line 39 to 41; scales in transverse line to base of ventral fin 6.5 to 8.5–1–5 to 6; several series of pores on front of snout; body with longitudinal dark lines following rows of scales; usually a round dark spot on caudal peduncle.
  5a. Length of head 4.7 to 5.2 in standard length-----------------leptocheilus
  5b. Length of head 4.2 to 4.3 in standard length-------------------- kuhlii

LABIOBARBUS BURMANICUS (Day)

Dangila burmanica Day, 1878, vol. 2, p. 546 (Moulmein, Tanoy).—Smith, 1933a, p. 80 (Patani River).

The only Thailand record for this Burmese species is for the Patani River at Patani, in the Peninsula, where a male specimen 14.5 cm. long was taken in a cast net October 15, 1923. The specimen agreed closely with Day's description and figure.

In describing this fish from Tanoy and Moulmein from specimens up to 10 inches in length, Day stated that it was closely allied to

Dangila kuhli (now *Labiobarbus kuhlii*) but that it appeared to differ therefrom in having a shorter head and fewer scales between the dorsal fin and the lateral line. In a recent examination of specimens from Tanoy in the Indian Museum in Calcutta, Dr. Sunder Lal Hora determined the number of circumpeduncular scales as 16 and the pharyngeal teeth as 5,4,2–2,4,5, thus agreeing with Weber and de Beaufort in the formula for the teeth in their generic definition, rather than with the formula 5,4,3–3,4,5 noted by Day.

The Malay name given to the fish at Patani is *ikan tubu.*

LABIOBARBUS SUMATRANUS (Bleeker)

Dangila sumatrana BLEEKER, 1852 (67), p. 596 (Solok, Sumatra).

There are a few Thailand records for this fish, otherwise known only from Borneo and Sumatra. The species was first observed in the Chantabun River, Southeastern Thailand, April 10, 1925, and three specimens were preserved. A specimen was taken in the Menam Wang at Lampang November 17, 1928. A third locality is Klong Chawang, east of Bandon in Peninsular Thailand, where the late R. Havmöller collected a specimen in February 1929.

The length of the fishes examined has ranged from 12 to 16 cm.

In the vicinity of Lampang the name for the fish is *pla kuk lien.*

LABIOBARBUS LINEATUS (Sauvage)

Dangila lineata SAUVAGE, 1878b, p. 237 (Stung-Strang, Laos).—SMITH, 1933a, p. 80 (Tapi River, Chantabun River).—FOWLER, 1934a, p. 115 (Chiengmai, Chiengsen).

Originally known only from what is now French Indo-China, this species in recent years has been found in Peninsular Thailand (Tale-Sap and Tapi River near Bandon), Southeastern area (Chantabun River), and Northern district (Chiengmai and Chiengsen). In the Tale Sap the fish is common, reaching a length of 15 cm. A specimen from the Tapi River was courteously examined by Dr. L. F. de Beaufort at the Zoological Museum in Amsterdam and found to be in agreement with Sauvage's description.

In the Chantabun River in May 1929 the fish was very abundant and in spawning condition; two ripe males 17 and 17.5 cm. long had large rostral tubercles and minute pearl organs on top of head and predorsal region. Many small buckets of ripe or nearly ripe eggs, lightly salted, were exposed for sale in the Chantabun market.

This species may be recognized by two transverse rows of rostral pores or tubercles on pores, and six to nine dark longitudinal stripes following the rows of scales.

In the Tale Sap this fish shares with other members of the genus the name *pla ta deng* (*ta deng*, red eye). In the Bandon district the vernacular name is *pla lao tong* (*lao tong*, golden spear). At Chantabun the fish bears the name generally given to *Labiobarbus* throughout Thailand, *pla sa.*

LABIOBARBUS SPILOPLEURA (H. M. Smith)

Figure 40

Dangila spilopleura Smith, 1934b, p. 307, pl. 10 (Menam Chao Phya, Menam Tachin, Menam Nakon Nayok).

Dangila siamensis Fowler, 1934a, p. 115 (Nakon Sritamarat, Bangkok, Chiengmai, Chiengsen); 1935a, p. 114, figs. 48–51 (Khao Nam Poo); 1935b, p. 510 (Old Chiengsen); 1937, p. 177 (Bangkok, Mepoon, Pitsanulok, Kemarat).

At the time this species was described seven specimens besides the type were available for examination: The type came from Hangkraben, a stream celebrated for the abundance of fishes and the importance of its commercial fisheries, lying off the Chao Phya River north of Ayuthia; six specimens came from Klong Don Lao, also a celebrated fishing ground tributary to the Tachin River; and one specimen came from the Nakon Nayok River, all these rivers being in communication through canals. No other specimens have been met with, although the species is probably not rare, and on the Tachin River it is known to fishermen and dealers by a distinctive vernacular name.

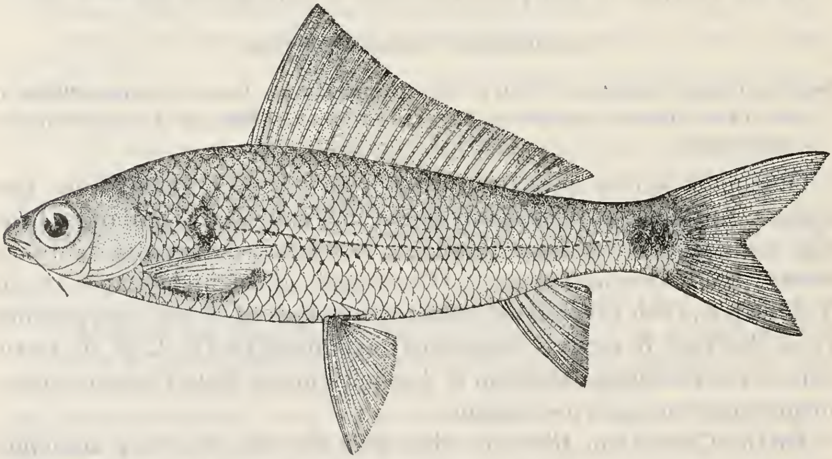


Figure 40.—*Labiobarbus spilopleura* (H. M. Smith). Drawn by Luang Masya; courtesy of the Thailand Government.

The principal characters are the rather elongate form (depth of body 3.6 times in standard length), 44 scales in the lateral line, 7.5–1–7.5 scales in the transverse line from midline of back to midline of abdomen, 6 scales between the lateral line and the base of the ventral fin, 20 scales around the narrow part of the caudal peduncle, the maxillary barbel more than twice the length of the rostral barbel, and 1.5 times the diameter of the eye, dorsal fin with 25 branched rays, of which the longest is equal to or slightly shorter than the head and somewhat less than the depth of the body, and pale green back and sides with whitish abdomen, a silvery sheen on body and head, each scale of back and upper sides with a dark brown spot at its base, a large hollow black spot of irregular diamond shape on the lateral line above the midlength of the pectoral fin, a round black spot the size of the eye on the caudal peduncle, and pale green or pale yellow fins.

The type of this species was a female, 12 cm. long, with well-developed ovaries taken December 11, 1924. Other specimens were 12 to 16 cm. long.

The diamond-shaped spot over the pectoral fin seems to be a diagnostic feature of this species, although Fowler (1935a) has shown for specimens he identified as *L. siamensis* (q. v.) variable clusters of black spots on the lateral line above the pectoral, and chiefly on this feature he suggests that *L. spilopleura* is a synonym of *L. siamensis.* It may be pointed out, however, that the lateral spot in the present species is quite different in shape and composition from that described and figured for the specimens assigned by Fowler to *L. siamensis*, and that there are other differences that make it difficult to consider the two forms as the same species. One of these differences is the presence in *L. spilopleura* of 44 scales in the lateral line, while in several lots of specimens of "*D. siamensis*" Fowler records the lateral line scales as 31 to 34, 33 to 36, and 34 to 37; another difference is that *L. spilopleura* has 20 circumpeduncular scales and *L. siamensis* of Fowler only 16 such scales.

Fowler (1939, p. 64) says: "It appears quite likely that the specimens I have recorded as *Dangila siamensis* in 1934, 1935, and 1937 are mostly, if not entirely, *Dangila spilopleura* H. M. Smith. That species should therefore remain validated, and replace the '*siamensis*' of my synopsis."

On the Nakon Nayok River this fish shares with others of the genus the colloquial name *pla sa.* On the Tachin River the fish is called *pla soi luk kluey* (*luk kluey*, banana).

LABIOBARBUS SIAMENSIS (Sauvage)

Dangila siamensis BLEEKER, 1865 (347), p. 35 (nomen nudum) (Siam); 1865 (356), p. 175 (nomen nudum) (Siam).—VON MARTENS, 1876, p. 401 (nomen nudum). (Bangkok).—SAUVAGE, 1881, pp. 162, 176 (Petchaburi, Bangkok); 1883b, p. 152 (Menam Chao Phya).—HORA, 1923b, p. 153 (Bangkok).—FOWLER, 1939, pp. 45, 68 (Trang, Krabi).

The first mention of this species was in a paper by Bleeker (347), published in 1865, followed by another (356) in the same year, in both of which the species was named but not described, Bleeker having had before him specimens collected by Bocourt at Petchaburi and Bangkok in 1862. The species was mentioned by von Martens in

1876, but here, too, the name only was cited. It was not until 1881 that a description was published, this description by Sauvage based on the same specimens, in the Muséum d'Histoire Naturelle in Paris. Although Sauvage credited the species to Bleeker, the credit belongs to Sauvage himself, for he wrote: "This species was named but not described, by Bleeker in his *Nouvelle notice sur la faune ichthyologique de Siam.* The description is made from the specimens labeled in the hand writing of the learned ichthyologist."

The original description is not wholly satisfactory and it is inapplicable in some particulars to specimens that in later years have been referred to the species. Thus, Sauvage described the upper lip as not fringed, but as a fringed upper lip is a generic character in *Labiobarbus* it is to be inferred that this feature was overlooked.

In October 1939 Dr. Jacques Pellegrin, of the National Museum of Natural History in Paris, very courteously responded to a request from the United States National Museum, and made a special examination of the types of *Dangila siamensis*, consisting of two specimens from Petchaburi. He gave the following information regarding them: They measure 137+30 and 130+30 mm. respectively; the scales in the lateral line are 43 to 45; the scales around the caudal peduncle number 20; the dorsal rays are 3 simple and 24 branched; there is a single row of pores on the front of the snout, as stated by Sauvage; and the upper lip in reality has a few fringes which, however, are not very distinct and are difficult to see. Other features brought out in the original description and not repeated by Dr. Pellegrin are: Depth of body contained 3.6 times and length of head nearly 5 times in the standard length; 8 scales above the lateral line and 5 scales between the lateral line and the base of the ventral fin; interrupted longitudinal lines on the body formed by a black spot on each side; and an indistinct black spot at the base of the caudal fin.

The first reference to this species in recent years was by Hora (1923b), who noted that a specimen 14.2 cm. long from the Menam Chao Phya at Bangkok agreed fairly closely with Sauvage's description; its upper lip, hidden beneath the rostral fold, was distinctly fringed.

A specimen taken in the Meping at Chiengmai March 10, 1924, was in general agreement with Sauvage's account and could not be made to fit the descriptions of any of the species recorded for India, Burma, and the Indo-Australian Archipelago. In the absence in Thailand of adequate material for comparison at that time, this specimen was sent to Dr. L. F. de Beaufort who, in June 1925, confirmed this identification.

As vernacular names of this fish, Hora (1923b) recorded *pla sa* for Bangkok, while at Chiengmai *pla soi uk* was heard.

LABIOBARBUS LEPTOCHEILUS (van Hasselt)

Dangila leptocheila VAN HASSELT, 1823, p. 132 (Batavia).—SMITH, 1933a, p. 80 (Menam Chao Phya at Bangkok, Nontaburi, Ayuthia, Chantabun River, Tale Sap, Patani River).—FOWLER, 1937, p. 176 (Pitsanulok).

Dangila cuvieri BOULENGER, 1903, p. 303 (Patani River, Patani Bay).—KOUMANS, 1937a, p. 64 (Peninsular Siam).

Dangila leptocheilus FOWLER, 1934a, p. 115 (Bangkok); 1935a, p. 115 (Bangkok).

The range of this species in Thailand includes the Peninsular, Central, and Southeastern sections, and extends thence to Malaya, Sumatra, Borneo, and Java.

The maximum length attained by Thai examples examined has been 25 cm., with many specimens up to 20 cm. long.

The comparatively short head (4.7 to 5.2 in standard length) is associated with a maxillary barbel much longer than the eye, a rostral barbel often as long as the eye, several transverse rows of pores on the front of the snout, 39 to 41 scales in the lateral line, a dorsal fin, which in local examples may have up to 27 branched rays, normally ill-defined dark longitudinal streaks along the rows of scales, and sometimes a large dark spot on the caudal peduncle near the base of the caudal fin. Occasionally the dark lines along the side are strongly marked, and there may be an obscure humeral spot.

According to Weber and de Beaufort, 16 or 18 scales surround the narrowest part of the caudal peduncle in this species. In Thailand 18 or 20 is the usual number, with 22 not infrequently present. Thus, of three specimens 10 to 11.5 cm. long taken in the Meklong at Ban Pong in October 1926 one had 20 and two had 22 circumpeduncular scales, and one specimen, 19.5 cm. long, collected at the same place in November 1924 had 22 such scales. In no other local species has a similar variation been found.

A specimen, 21.5 cm. long taken in the Menam Chao Phya near Ayuthia December 9, 1923, had the left rostral barbel bifurcated at half its length.

The spawning season varies with the region and lasts most of the year. In Peninsular Thailand (Nakon Sritamarat) a fish 20.5 cm. long taken July 4, 1928, had well-developed eggs; in the Southeastern region (Chantabun River) a fish 20.5 cm. long taken March 30, 1925, contained nearly ripe eggs; in Central Thailand (Menam Chao Phya) fish are found with eggs up to the end of the rainy season in October.

In different parts of its range this fish has different vernacular names. In the Bangkok region and in other sections the usual designation is *pla soi*, often with qualifying words. The common dove (*Streptopelia chinensis tigrina*), with an area of conspicuous small black spots on the side of its breast, is known as *nok khao*, and the fish, with its black spots on the side, is called *pla soi nok khao* in fancied resemblance to the dove. The cotton tree or kapok (*Bombax*) known as *mai nun*, bears pods called *luk nun* (or nun-tree fruit), the shape of which has suggested *pla soi luk nun* as a name for this fish. In the province of Nakon Sritamarat the fish is generally known as *pla lao tong* (golden-spear fish).

LABIOBARBUS KUHLII (Cuvier and Valenciennes)

Dangila kuhlii Cuvier and Valenciennes, 1842, vol. 16, p. 231 (Java).

There is no published reference to the occurrence in Thailand of this species of Java and Sumatra. It has been collected at Bangkok, in the Menam Chao Phya above Bangkok, in the lower Menam Nan, and in Bung Borapet. Because of its similarity to *L. leptocheilus* it is undoubtedly often misidentified, and *L. kuhlii* is probably more common than preserved material would indicate.

This fish was first met with in Thailand in the upper Menam Chao Phya at Bangtang on November 17, 1923, when a specimen 15 cm. long was caught with a cast net. The next day, in the lower Menam Nan, a specimen 18.8 cm. long was obtained with a yokyaw (large dip net). In March 1931 specimens were collected in Bung Borapet by Luang Masya Chitrakarn, of the Siamese Bureau of Fisheries.

On May 21, 1926, a fish about 20 cm. long with well-developed ova was found dying in a klong in Tonburi, a part of Bangkok. In life the lustrous sheen of the body and head was relieved by black longitudinal stripes on the back and sides following the rows of scales; the dorsal and caudal fins were dusky green, with a row of black spots on the middle of the dorsal membranes; the anal and ventral fins were pale salmon-pink; the pectorals were pale green. This specimen was taken to the Zoological Museum in Amsterdam and compared with a specimen of *L. kuhlii* from Gunung Sahilan, Sumatra, and found to be in close agreement therewith; it was found to differ from specimens of *L. cuvieri* Boulenger (i. e., *L. leptocheilus*) from the River Batang Hari, Sumatra, in the conspicuously larger head.

In specimens 19 to 20 cm. long in the U. S. National Museum from Bung Borapet, the head is about 4.3 in standard length; the eye is 3.5 in head, 1 in snout, and 1.8 or 1.9 in interorbital space; the maxillary barbel is about twice the diameter of the eye; the tubule-bearing scales in the lateral line number 38 to 41, the scales in transverse series to the base of the ventral fin are 7.5 or 8.5–1–5.5 or 6, the circumpeduncular scales number 22; there are dark longitudinal streaks following the rows of scales, and there is a diffuse round black spot larger than eye on the caudal peduncle.

In squamation, barbels, fins, and coloration the fish bears a close resemblance to *L. leptocheilus* and may be found to intergrade therewith, but was considered distinct by Bleeker, Günther, and Weber and de Beaufort chiefly on account of its larger head, which is contained four times or a little more in the standard length as compared with a head 4.7 to 5.2 times in the length in *L. leptocheilus.* This difference was insisted on by Bleeker and is well shown in the plates in his Atlas.

Genus AMBLYRHYNCHICHTHYS Bleeker

Amblyrhynchichthys BLEEKER (261), Nat. Tijdschr. Nederl. Indië, vol. 20, p. 430, 1859. (Type, *Barbus truncatus* Bleeker.)

AMBLYRHYNCHICHTHYS TRUNCATUS (Bleeker)

FIGURE 41

Barbus truncatus BLEEKER, 1851 (26), p. 13 (Bandjermassing, Borneo).

Amblyrhynchichthys truncatus BLEEKER, 1865 (356), p. 176 (Siam).—WEBER and DE BEAUFORT, 1916, vol. 3, p. 105 (Siam).—Hora, 1923b, p. 153 (Bangkok).—FOWLER, 1934a, p. 115 (Chiengsen); 1937, p. 174 (Bangkok, Mepoon, Kemarat); 1939, p. 44 (Krabi).

Amblyrhynchithys truncatus SAUVAGE, 1883b, p. 152 (Menam Chao Phya).

This species, occurring in Borneo and Sumatra, is fairly common in streams in Central Thailand. It has been noted in the Menam Chao Phya from Bangkok to Paknampo, in the lower Menam Nan and Bung Borapet, in the Menam Pasak at Dha Luang, and in the Meklong at Rajaburi. The only record of the fish in Peninsular Siam is for the Tapi River near Bandon, where the writer collected a number of specimens in September 1923. More recently H. W. Fowler reported the fish from the Mekong at Kemarat. The British Museum contains a number of specimens from the Menam Chao Phya, gift of the Siamese Museum.

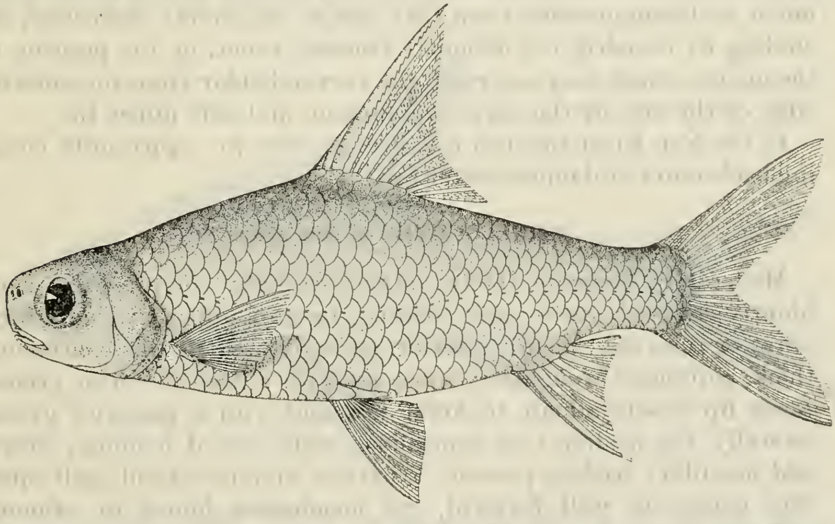


FIGURE 41.—*Amblyrhynchichthys truncatus* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

A length of 40 cm. is reached in Thai waters, but examples over 30 cm. long are not common.

The fish is well known to most fisherman in Central Thialand and usually bears a distinctive popular name but sometimes it is not distinguished by name from *Cyclocheilichthys.* Throughout the basin of the Menam Chao Phya, the common vernacular name is *pla ta luerk*, with *pla ta min* heard in some places. In the Pasak River the fish is usually called *pla takok*, while in the Tapi River a name not heard elsewhere and not given to any other species is *pla ta lun* or *pla ta lon.*

Genus XENOCHEILICHTHYS H. M. Smith

Xenocheilichthys H. M. SMITH, Journ. Siam. Soc., Nat. Hist. Suppl., vol. 9, p. 304, 1934. (Type, *Xenocheilichthys gudgeri* H. M. Smith.)

XENOCHEILICHTHYS GUDGERI H. M. Smith

Xenocheilichthys gudgeri SMITH, 1934b, p. 305, fig. (Nan River).—FOWLER, 1937, p. 174, figs. 110, 111 (Kemarat).

A rare species, known from three specimens (U.S.N.M. Nos. 103367 and 103368, type and paratypes, respectively) from the upper Nan River near the town of Nan, Northern Thailand, and from one specimen from the Mekong at Kemarat, Eastern Thailand.

These specimens measured 13.5, 14, and 14.5 cm. in length.

The fish bears some resemblance to *Amblyrhynchichthys truncatus* (Bleeker) in such features as an annular eyelid, a postsymphyseal tubercle on the lower jaw, no barbels, peculiar shape of the mouth and lips, and a short dorsal fin with strongly ossified and serrated spine, but it is distinguishable from that species by several characters, including its rounded, not obliquely truncate snout, by the position of the mouth, which may not reach the perpendicular from the anterior edge of the eye, by the very thick, broad, and soft upper lip.

In the Nan River this fish is called *pla nam fai*, apparently meaning back-water or damned-water fish.

PAPILLOCHEILUS, new genus

Moderately elongate, body rather strongly compressed; snout bluntly rounded, entire, and covering base of upper lip; no rostral pores or tubercles; mouth inferior, strongly arched; lips continuous, thick, papillose throughout; upper lip with a deep posterior groove, lower lip closely aduate to lower jaw and with a posterior groove laterally, the median part continuous with skin of isthmus; rostral and maxillary barbels present; a narrow annular eyelid; gill openings extending well forward, gill membranes joined to isthmus; gill rakers few; pharyngeal teeth triserial; scales in moderate number, lateral line complete and running to midbase of caudal fin;

dorsal fin originating over base of ventrals, rays in moderate number, last simple ray osseous and denticulated; anal rays few; base of dorsal and anal fins with a scaly sheath.

Genotype.—Papillocheilus ayuthiae, new species.

Similar to *Labeo* but with the last simple dorsal ray osseous and denticulated, the branched dorsal rays in reduced number, and the lips thick and papillose.

PAPILLOCHEILUS AYUTHIAE, new species

Figure 42

Description.—Body rather strongly compressed, depth 3 in standard length; caudal peduncle rather broad, its least depth 1.5 in its length and 2 in head; head 3.4 in standard length, moderately compressed; greatest width of head 1.8 in its length; snout without pores or tubercles, rather blunt, decurved, overhanging the mouth, about 3.1 in head; eye equal to snout and less than the broad, flat interorbital space; a narrow annular eyelid; mouth small, inferior; lips continuous, rather closely adnate to jaws and completely covered with low, round papillae; lower lip broad, with a postlabial groove laterally, the broad median part continuous with the skin of the isthmus; a pair of rostral and of maxillary barbels, subequal, less than half diameter of eye; teeth uncinate, 5, 4, 1—1, 4, 5; gill openings extending forward to under posterior edge of eyes leaving a rather narrow isthmus to which the gill membranes are connected; gill rakers short, wide-spaced, about 14 on lower arm of first arch, with about 2 short stubs on upper arm.

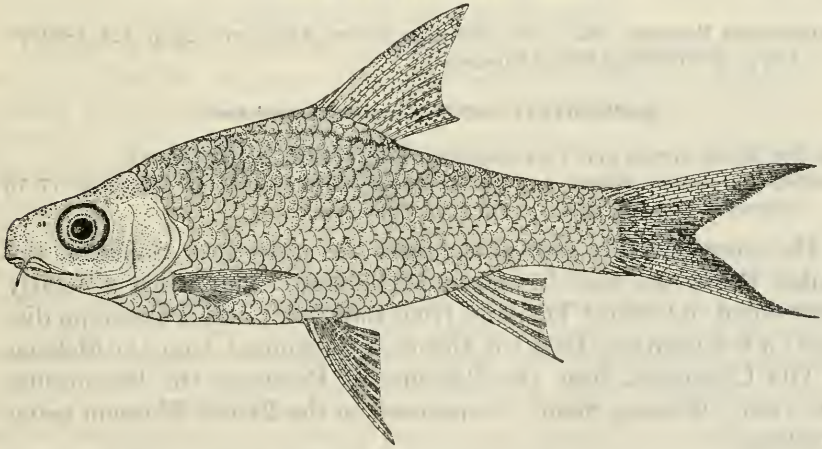


Figure 42.—*Papillocheilus ayuthiae*, new species: Type (U.S.N.M. No. 119495). Drawn by Mrs. Alice C. Mullen.

Squamation: Scales in lateral line 36, in transverse line from middle of back to middle of ventral surface 7.5–1–5.5, between lateral line and base of ventral fin 4, in predorsal region 14, circumpeduncular 16; base of dorsal and anal fins scaly; lateral line gently decurved, descending to about seventeenth scale of lateral line, thence running nearly straight to midbase of caudal.

Fins: Dorsal fin arising over base of ventrals, midway between tip of snout and base of caudal fin; dorsal rays iv, 8; last simple ray about as long as head, ossified, and bearing 17 or 18 prominent denticulations and about 5 minute ones; free margin of dorsal concave; caudal deeply forked, longer than head; anal rays iii, 5, last simple ray 0.75 head; ventrals and pectorals subequal, ventrals reaching to anal and pectorals reaching nearly to ventrals.

Coloration: Body and head uniform silvery white; dorsal membranes with scattered minute black spots; caudal membranes dusky, becoming more intense along inner sides of the lobes; other fins hyaline.

Type and paratype.—The type (U.S.N.M. No. 119495), 6.9 cm. long, was taken July 21, 1923, from a short tributary of the Menam Chao Phya near the ancient capital city of Ayuthia. A paratype (U.S.N.M. No. 119496), with the same data, is 6.6 cm. long.

Remarks.—This species, easily recognized by a combination of characters (thick lips completely covered with low papillae, narrow annular eyelid, absence of rostral pores or tubercles, dorsal fin with 8 branched rays and a strongly ossified and denticulated last simple ray, etc.), was not met with elsewhere or on any other occasion.

Genus BARBICHTHYS Bleeker

Barbichthys Bleeker (261), Nat. Tijdschr. Nederl.-Indië, vol. 20, p. 424, 1859–60. (Type, *Barbichthys laevis* Bleeker.)

BARBICHTHYS LAEVIS (Cuvier and Valenciennes)

Barbus laevis Cuvier and Valenciennes, 1842, vol. 16, p. 192 (Java).
Barbichthys laevis Weber and de Beaufort, 1916, vol. 3, p. 208, figs. 77–79 (Siam).—Fowler, 1935b, p. 513 (Old Chiengsen).

The range of this species embraces Java, Borneo, Sumatra, the Malay Peninsula, Indo-China, and Thailand. The fish is generally distributed in Central Thailand from Bangkok to the Paknampo district; it is known also from the Mekok at Chiengmai, from the Mekong at Old Chiengsen, from the Province of Patani in the Peninusula, and from "Western Siam" (a specimen in the British Museum being so labeled).

A length of 34 cm. is attained by the fish in the East Indies but examples over 25 cm. long are not often met with in Thailand.

In the Thai vernacular this fish bears a variety of names in different localities. The most common are *pla hua liem* (angular-head fish) and *pla hang buang*, heard in the basin of the Menam Chao Phya. At Chiengrai the fish is called *pla klom hang wong*.

Genus TYLOGNATHUS Heckel

Tylognathus HECKEL, *in* Russegger's Reisen, vol. 1, pt. 2, p. 1027, 1843. (Type, *Varicorhinus diplostomus* Heckel.)

The genus *Tylognathus*, as proposed by Heckel (1843), was composite. Bleeker (1863 [314]) made *Varicorhinus diplostomus* Heckel from Kashmir the type of the genus, a species placed by Günther and Day in the genus *Labeo*. If this disposition of *diplostomus* is sound, *Tylognathus* is not a tenable name for these or other fishes, and both *Tylognathus* and *Varicorhinus* may be synonyms of *Labeo*.

The availability of the name *Tylognathus* was questioned by Jordan (1919, pt. 2, p. 211). Hamilton (1822) set aside a group of 10 cyprinoid fishes having, among other features, a median postsymphyseal longitudinal ridge on the inside of the lower jaw as in the sea mullets, and called them *Bangana*, this being a vernacular Indian name for fishes of the genus *Mugil*. Jordan made Hamilton's *dero* the type of *Bangana*, it being the first species mentioned, and stated that *Bangana* "probably replaces *Tylognathus* Heckel and *Lobocheilus* van Hasselt." Specimens of *dero* supplied by the Indian Museum in Calcutta, through the courtesy of Dr. S. L. Hora, do not have a postsymphyseal ridge as called for by Hamilton's definition of the genus, and this species is identified by Hora and others as a *Labeo*. *Tylognathus* of Heckel and *Lobocheilus* of van Hasselt lack this feature. It is believed that Jordan was in error in this view.

The figure of a *Tylognathus* given by Weber and de Beaufort (1916, vol. 3, p. 219, fig. 88) and their definition as affecting the lower lip pertain to *Lobocheilus*, as herein conceived. Dr. de Beaufort, in describing a new species of *Tylognathus* from Thailand (*T. siamensis*), drew attention to the differences between it and Indo-Australian forms:

> The structure of the lower lip in this species differs somewhat from that in Indo-Australian species, the only ones I am acquainted with. In the last-named we can recognize (see Weber & de Beaufort, Fishes of the Indo-Australian Archipelago, Vol. III, p. 219) a median part of the lower lip, which is much enlarged and swollen, and expanded laterally so as to cover the lateral parts of this lip, which are continuous with the upper lip round the corner of the mouth. To see those lateral parts one has to lift the median part. In the species described above this median part is much smaller and does not cover the lateral parts. Another difference is noticeable in the lower jaw. This is covered in Indo-Australian species by a very thick mass, probably consisting of connective tissue and forming a sharp transverse ridge in front. This ridge is present also in the Siamese species, but the thick pad is not developed here.

The species of *Tylognathus* may be differentiated as follows:

1*a*. No barbels; scales in lateral line 27; coloration mostly pale brown above; silvery white below, small examples with a dark spot at caudal base ---------- **brunneus**
1*b*. A pair of maxillary barbels; scales in lateral line 32 to 36; coloration various.
  2*a*. Circumpeduncular scales 16; scales in transverse series to base of ventral fin 6–1–4; gill rakers about 8+25; a faint median longitudinal dark stripe deficient anteriorly, most distinct on caudal peduncle, where there is a round black spot about size of pupil; dorsal fin with no sharply defined dark edge ---------- **caudimaculatus**
  2*b*. Circumpeduncular scales 18: scales in transverse series to base of ventral fin 6–1–5; gill rakers about 6+30; a round dark spot about size of eye on caudal peduncle; dorsal fin with a narrow sharply defined dark edge ---------- **entmema**
  2*c*. Circumpeduncular scales 20; scales in transverse series to base of ventral fin 5.5–1–4; gill rakers about 9+34; dorsal fin with a sharply defined narrow dark border ---------- **siamensis**

TYLOGNATHUS BRUNNEUS Fowler

Tylognathus brunneus Fowler, 1934a, p. 131, figs. 87, 88 (Chiengmai, Chiengsen); 1935a, p. 125 (Bangkok, Khao Nam Poo).

This species is unique among Thai members of the genus for its absence of barbels. Numerous specimens from the Meping at Chiengmai, the Mekong at Chiengsen, and the basin of the Menam Chao Phya at Khao Nam Poo and Bangkok are from 4.1 to 19.1 cm. long.

The original description gives 28 or 29 scales in the lateral line to the base of the caudal fin and 3 more scales on the fin; the figure, however, shows only 27 scales in all. As the drawing on which the figure is based was made by Mr. Fowler, the latter scale count has been used in the key.

TYLOGNATHUS CAUDIMACULATUS Fowler

Tylognathus caudimaculatus Fowler, 1934a, p. 133, figs. 89, 90 (Chiengmai); 1935a, p. 125 (Srisawat).

The type, 5.8 cm. long, and numerous other specimens, 3.2 to 5 cm. long, came from the Meping at Chiengmai. A single specimen from Srisawat was 12.7 cm. long. The species is comparatively plain, with an obscure longitudinal dark stripe along middle of body becoming more distinct posteriorly, and with a round black spot about size of pupil on caudal peduncle, and the dorsal membranes are medianly dark and have a gray free margin.

A specimen, 9 cm. long, taken in the Menam Chao Phya at Bang Pang, Central Thailand, November 25, 1923, is closer to *T. caudimaculatus* than any other species ascribed to that country but presents some differences, which may be due in part to the larger size than specimens described by Fowler. The specimen is a male, with the top of head, back, and sides thickly studded with minute pearl organs, which extend to the base of the caudal fin. The essential features are: Depth 3.75, head 4.2, least depth of caudal peduncle 1.5 in its length and less than 2 in head, a maxillary barbel less than 0.5 eye, upper lip entire, lower lip papillated; scales in lateral line 37, in transverse line to base of ventral fin 5.5–1–3, in predorsal region 12, around narrowest part of caudal peduncle 16; a round black spot as large as eye at base of caudal fin, with a faint dark line extending forward therefrom about half length of body; median part of each dorsal membrane with a line of dark specks parallel with the rays.

TYLOGNATHUS ENTMEMA Fowler

Tylognathus entmema FOWLER, 1934a, p. 134, figs. 101, 102 (Bangkok).

This species is based on a specimen, 6.4 cm. long, from a canal in Bangkok; it is obviously immature. Only the type is known. The body is very deep (3 in standard length), there is a minute maxillary barbel, a round dark spot about the size of the eye occupies the posterior part of the caudal peduncle, and there is a narrow dark edge on the dorsal fin. The scales in the lateral line number 33 (35 in the cut) and between the lateral line and the ventral fin there are 5 scales. The specific name (*entmema*, a notch) has reference to a "slight asymmetrical notch" on one side of the rostral fold (also referred to as "the upper jaw edge"). It is believed that, because of its position and the fact that such a feature is not found elsewhere in this genus, the notch is an abnormality or represents an injury, and is a feature that should not be perpetuated in a specific name.

TYLOGNATHUS SIAMENSIS de Beaufort

Tylognathus siamensis DE BEAUFORT, 1927, p. 5 (Payao Swamp, Menam Chao Phya).

This was the first species of *Tylognathus* recorded for Thailand. The specific description by Dr. de Beaufort was based on two specimens collected by the writer in 1924, one in Payao Swamp, between Lampang and Chiengrai, and one in a branch of the Menam Chao Phya at Lopburi; the specimens were 13.5 and 11 cm. long. At the time the type was obtained in Payao Swamp, on March 5, 1924, this was one of the most abundant fishes, and many specimens were preserved. Other specimens agreeing with the original description were taken in the Menam Sak at Dha Luang August 30, 1923; in the Menam Chao Phya at Paknam, August 9, 1923, and in the same stream at Bang Pang, November 25, 1923, at Bang Pa-in, December 10, 1924, and a short distance above Bangkok, January 4, 1925. Specimens were obtained also from Bung Borapet, November 19, 1923. A fine series, 9.6 to 11.5 cm. long, caught in the Nan River on April 23, 1930, was brought in by Luang Praserth Aksorn, then with the Siamese Bureau of Fisheries.

This is a comparatively small species, with a maximum length of 15 cm. among the specimens examined. The Deignan collection contains 28 specimens, 7.5 to 10.2 cm. long, from the Mechem, tributary of the Meping, July 1 to 5, 1935. These were taken by A. R. Buchanan and P. D. Harrisson, of Chiengmai. From the Menam Nan at Nan on March 29, 1936, Deignan took six specimens 9.6 to 11.6 cm. long, one of them 11 cm. long being a female with large eggs. A further specimen 9.7 cm. long was from the Meta, a branch of the Mechem, February 1936.

Specimens taken in December have a marked development of pearl organs on the top and sides of the head and on the back as far as the dorsal fin; and females 9.6 cm. long with large ovaries are among specimens collected in January.

Vast schools of this species and other small cyprinoids begin to move upstream in the large rivers after the end of the rainy season and constitute one of the most outstanding phenomena of fish life in Central Thailand. Such fish are called *pla soi* by the Thai.

Genus HOLOTYLOGNATHUS Fowler

Holotylognathus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, p. 135, 1934. (Type, *Holotylognathus reticulatus* Fowler.)

The genus *Holotylognathus*, established for the accommodation of *H. reticulatus* Fowler, has as its outstanding character the absence of a lateral line; otherwise there is general agreement with *Tylognathus*.

HOLOTYLOGNATHUS RETICULATUS Fowler

Holotylognathus reticulatus Fowler, 1934a, p. 135, figs. 97, 98 (Eastern and Northern Siam).

This species is represented by many specimens 3.4 to 8.3 cm. long. The type and several other specimens came from Bua Yai, on the Mekong in Eastern Thailand, and several hundred specimens came from Chiengmai and the Metang in Northern Thailand.

The single pair of small barbels are rostral. The broad lips are fleshy, the upper plicate, the lower papillate. The fin formulae are as in *Tylognathus*. The dorsal fin is situated well forward, its origin in advance of ventrals and over the tip of the pectorals. The scales, in very regular lengthwise and transverse rows, number 34 in lateral series, 9 in cross series, and 9 predorsal. The coloration is plain except for a large round black spot on the posterior part of the caudal peduncle, and each scale of back and sides has a dark edge, forming a reticulated pattern.

Genus LOBOCHEILUS van Hasselt

Lobocheilus van Hasselt, Alg. Konst. Letterbode, vol. 2, p. 132, 1823. (Type, *Lobocheilus falcifer* van Hasselt.)

The lobocheilids are mostly inhabitants of swift waters, often mountain brooks, but may frequent still waters, such as the Tale Sap. They are vegetarians. Their long, regularly coiled intestine is nearly always crowded with algae and other aquatic plants cropped from stones and logs. Feeding is facilitated by the sharp-edged, horny covering of the lower jaw and the development of a large, freely movable fleshy pad constituting the superficial part of the lower lip.

There seems to be no valid reason why the name *Lobocheilus* should not be used, in the sense exemplified by Bleeker (1863 (314) and 1863 (301), vol. 3), for fishes that conform with the generic characters of van Hasselt's haplotype *L. falcifer*.

Bleeker, in various papers, credited the genus and the type species to van Hasselt. Cuvier and Valenciennes (1842, vol. 16), however, called van Hasselt's fish *Labeo falcifer* "nobis," without giving van Hasselt credit for the earlier use of the specific name. Günther (1868, vol. 7, p. 65) called the fish *Tylognathus falcifer*, credited the species to Cuvier and Valenciennes, and placed *Lobocheilus falcifer* van Hasselt in the synonymy. Weber and de Beaufort (1916, vol. 3) followed Günther and made no reference to van Hasselt.

Following a detailed definition of the genus *Lobocheilus*, Bleeker (1863 (301), vol. 3) wrote:

> The shape of the lips and jaws takes, in this remarkable genus, a character quite special, in that the lower lip, which forms a free and rounded lobe, received the upper lip only upon the posterior part of its upper surface. This arrangement is met with again neither in the cyprinoids nor in any other family of fishes. Although this character suffices quite well to distinguish this genus, one can add to it the simple form and the thickness of the lower jaw, the form of the postlabial groove, the absence of rostral lobes and of labial papillae, etc.

The use of the name *Lobocheilus* for certain Thai fishes will leave the generic name *Tylognathus* of Heckel (1843) available for fishes of this general form in which the lower lip is not provided with a conspicuous free superficial lobe. All of the local species have only maxillary barbels; several species of the East Indies have both maxillary and rostral barbels.

In the present account, 12 local species are recognized, all but one peculiar to Thailand. Several of them may be eliminated when more material is available for examination and comparison. The species may be differentiated as follows:

1*a*. Body moderately elongate, depth 3 to 4 in standard length.
  2*a*. Back and side without longitudinal stripes; head small, 4.6 to 4.9 in length; pectoral fins equal to or longer than head................bo
  2*b*. A single dark longitudinal stripe or band along side; head 4 to 4.5 in length; pectoral fins less than head.

3*a*. Each scale of back and of side as low as ventral fin with a conspicuous dark basal crescentic spot; rostral tubercles in 2 rows; mouth 0.5 width of head; length of caudal peduncle 1.5 times its depth; origin of dorsal fin far in advance of ventrals, over eighth scale of lateral line -- **melanotaenia**

3*b*. Each scale of back and side without a dark basal spot; rostral tubercles in 4 rows divided into 2 series by a transverse groove; mouth as wide as head; length of caudal peduncle 2 times its depth; dorsal fin well in advance of ventral, over tenth scale of lateral line---- **nigrovittatus**

2*c*. Multiple dark longitudinal stripes on back and side; pectoral fins equal to or less than head.

4*a*. Four dark longitudinal stripes on posterior half of body.

5*a*. Each scale of back with a blackish basal pocket; head rather small, 4.4 to 5.4 in length; 4 series of rostral tubercles not divided by a deep horizontal groove; least depth of caudal peduncle much more than 0.5 its length and much more than 0.5 length of head- **quadrilineatus**

5*b*. Each scale of back and side without a dark basal pocket; an elongate black blotch at posterior end of lateral line extending on median caudal rays; head larger, 4 in length; 4 series of rostral tubercles divided into 2 parts by a deep horizontal groove; least depth of caudal peduncle 1.5 in its length and 0.5 length of head-- **trangensis**

4*b*. Five or 6 dark longitudinal stripes on posterior two-thirds of body; head 4 to 4.3 in length; 4 series of large rostral tubercles divided into 2 parts by a deep horizontal groove; least depth of caudal peduncle 0.5 its length and 0.5 length of head---------------------- **cornutus**

4*c*. Eight or 9 dark, not sharply defined, longitudinal lines following rows of scales on back and side.

6*a*. Anterior margin of dorsal fin black; free edge of dorsal fin with a narrow, sharply defined black border; 2 short, diffuse dark gray cross bars on caudal peduncle near base of caudal fin; least depth of caudal peduncle 1.4 in head---------------------- **cryptopogon**

6*b*. Anterior margin and free edge of dorsal fin not black; a dark line along body axis terminating in an elongate black blotch on caudal peduncle; caudal peduncle about length of head----------- **davisi**

1*b*. Body more elongate, depth 4.2 to 5 in standard length.

7*a*. Body marked by a single more or less complete dark longitudinal band or stripe.

8*a*. A dark longitudinal stripe on posterior half of body terminating in a small round spot on caudal peduncle; a dark median dorsal streak; dorsal fin pale; origin of dorsal fin over base of ventrals; depth 4.2 to 4.5; head 3.3 to 3.5; gill rakers about 5+28; scales in transverse series 6 or 7–1–3-- **rhabdoura**

8*b*. A jet-black longitudinal band from head to posterior end of middle caudal rays; no dark median dorsal streak; dorsal fin with its anterior margin black and its membranes mostly blackish; origin of dorsal fin in advance of ventrals; depth 4.5; head 4.3; gill rakers 5+22; scales in transverse series 5.5–1–3--------------------------------- **cheveyi**

7*b*. Body marked with multiple dark longitudinal lines.

9*a*. Three dark longitudinal stripes on posterior part of body; dorsal, anal, ventral, and pectoral fins falcate; depth 4.5 to 4.75; head 3.8 to 4.2. **gracilis**

9*b*. Nine dark longitudinal stripes extending entire length of body, one on each side of lateral line most distinct; a large dark spot on caudal peduncle near base of caudal fin; fins not falcate, depth 5; head 5------. **thavili**

LOBOCHEILUS BO (Popta)

Tylognathus bo POPTA, 1904, p. 199 (Borneo).—KOUMANS, 1937a, p. 63 (inner lake of Tale Sap).

This species was described in 1904 from specimens, 11.1 to 29.4 cm. long, from the Bo River in Central Borneo, and until recently has been known from no other locality. The fish is admitted to the present catalog because of its discovery in widely separated parts of Thailand.

One specimen 16.7 cm. long was taken by the writer in the Mekok, a tributary of the Mekong, in Northern Thailand, March 2, 1924. This specimen agrees very closely with the descriptions and figure given by Dr. Popta (1904, 1906, fig. 26). The differences, which are of a minor character and may easily fall within the limits of individual variation, include slightly shorter barbels (0.5 eye in Thailand example as against 0.8 eye in Bornean specimens); and there are several obscure dark longitudinal lines following the rows of scales in the posterior part of the body, such lines not being referred to in the descriptions but suggested in Popta's figure reproduced from a photograph.

A second specimen, 15 cm. long, collected by the writer in the Nakon Nayok River, Central Thailand, July 10, 1930, likewise agrees with Bornean specimens: Scales in lateral line 33, in transverse line to base of ventral fin 5.5–1–3.5, in predorsal region 11, and around narrowest part of caudal peduncle 16; depth 4 in standard length; head 4.5 in length; maxillary barbels 0.8 eye; dorsal fin arising over eleventh scale of lateral line, its longest ray longer than head; caudal fin deeply forked, longer than head; anal and ventral fins subequal and shorter than pectorals which are 0.9 head. The fish is a female, with well-developed eggs, and has 3 rows of large pores on the snout. On the median line of the side posterior to the dorsal fin there is a large dark diffuse spot through which several dark lines extend to the base of the caudal fin.

A third specimen has been reported from the inner lake of the Tale Sap in Peninsular Siam by Dr. Koumans, who compared his specimen, measuring 18 cm., with the type, 29.4 cm. long, in the Leiden Museum.

At Chiengrai this fish is known as *pla klom pak wong* (literally, circular-mouth fish).

LOBOCHEILUS MELANOTAENIA (Fowler)

Tylognathus melanotaenia FOWLER, 1935a, p. 122, figs. 65, 66 (Khao Nam Poo); 1937, p. 210 (Kemarat).

Originally described from a single specimen, 15.8 cm. long, from Khao Nam Poo in Central Thailand, this species was subsequently reported from the Mekong at Kemarat in Eastern Thailand, where three specimens 14.2 to 15.8 cm. long were taken. The outstanding feature is a narrow dark brown or black band extending from the head to the tips of the median caudal rays, with each scale of the back and of the side as low as the base of the ventral fin having a dark brown or black basal crescent.

The recording (Fowler, 1935a) of the pharyngeal teeth on one side in four rows (5, 5, 4, 2) is unexpected, as in this genus and in *Tylognathus* these teeth are normally triserial.

The differences that appear to separate this species from *L. nigrovittatus* are indicated under the discussion of the latter.

LOBOCHEILUS NIGROVITTATUS, new species

FIGURE 43

Description.—Depth of body 4.12 in standard length; least depth of caudal peduncle 2 in its length and in head; profile from tip of snout to dorsal fin very slightly curved; head 4.5 in standard length, its depth at nape slightly greater than its width at opercles; snout broadly rounded, 1.4 in length of head and equal to the moderately convex interorbital space; snout from tip to a point under nostrils covered with large tubercles arranged in 2 groups of 2 rows each separated by a deep groove; mouth wide, extending nearly full width of head, overhung by the snout for a distance equal to diameter of eye; upper lip smooth; large superficial lobe of lower lip with a broad edge of papillae and covering the conspicuous horny sheath of the lower jaw, with the inner part of the lower lip small and attached laterally to the inner base of the lobed portion; a pair of maxillary barbels less than 0.5 diameter of eye; eye small, in midlength of head, 4.5 in head, 2 in snout, 2.25 in interorbital space; pharyngeal teeth 5, 4, 2—2, 4, 5, small, compact, with narrow grinding surface; gill-rakers short, club-shaped, closely approximated, 8+31 on first arch.

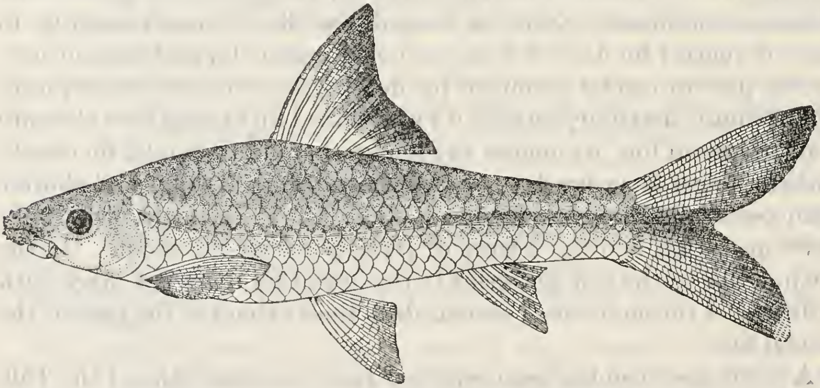


FIGURE 43.—*Lobocheilus nigrovittatus*, new species: Type (U.S.N.M. No. 109772). Drawn by Mrs. Aime M. Awl.

Squamation: Scales in lateral line 33 (including all tube-bearing), scales in transverse series from midline of back to median ventral surface 5.5–1–5.5, scales between lateral line and base of ventral fin 3.5, predorsal scales 10, circumpeduncular scales 16.

Fins: Dorsal fin arising well in advance of ventrals, over ninth scale of lateral line, nearly midway between eye and anal fin; dorsal rays iii,8, longest branched ray a little longer than head; free edge of dorsal fin moderately emarginate; caudal fin deeply forked, lobes much longer than head, upper lobe longest; anal fin emarginate, rays iii, 5, longest branched ray 1.5 in head; ventrals arising under twelfth scale of lateral line, shorter than pectorals, rays, i,8; pectorals 0.8 head, rays i,15.

Coloration: Upper surface of head and body light brown, under surface whitish; a black band along axis of body extending from head to base of caudal fin and thence on midcaudal rays, the band becoming wider on the caudal peduncle; a single row of scales both above and below the black band pale yellowish golden; dorsal fin with dusky margin and membranes; caudal margin dusky; anal, ventral, and pectoral fins hyaline.

Type and paratypes.—The type (U.S.N.M. No. 109772) is a male, 17.3 cm. long, collected by Layang Gaddi, July 19, 1925, in Lam Tong Lang, an eastern tributary of the Pasag River in Central Thailand. Paratypes (U.S.N.M. Nos. 109770, 109771, and 117628), taken at the same time and place number six and are 13.2 to 16.3 cm. long.

Other specimens.—Another specimen 15.1 cm. long was taken June 5, 1934, near Pakjong in headwaters of the Menam Mun.

Remarks.—This specimen resembles *L. melanotaenia* in having a black band along the side of the body and is in general agreement therewith in squamation and fin rays. It lacks the sharply defined dark crescent at the base of each scale on the back and side as low as the ventral fin and lacks also a blackish stripe on the side of the head in front of, under, and behind the eye (not referred to in Fowler's description but shown in his drawing). The body is more elongate (depth 4 as against 3.25 to 3.75), and there is no arching of the dorsal profile between the head and the dorsal fin as shown in Fowler's figure. The rostral tubercles, instead of forming two rows as in *L. melanotaenia*, are in four rows, divided into two series by a rather deep transverse groove, which may extend entirely around the snout. The mouth is wider, occupying nearly the entire width of the head, whereas in *L. melanotaenia*, according to the figure of the type, the mouth is only a little more than 0.5 the width of the head. The caudal peduncle is more slender, its least depth 0.5 its length as compared with 0.75 its length in *L. melanotaenia*.

In the mountainous region between the headwaters of the Menam Mun and the Menam Sak, where this species abounds, it is known to the inhabitants as *pla bok.*

LOBOCHEILUS QUADRILINEATUS (Fowler)

Tylognathus quadrilineatus FOWLER, 1935a, p. 124, figs. 67, 68 (Srisawat, Khao Nam Poo).

The type from Srisawat was 25.8 cm. long. Other specimens from the type locality and from Khao Nam Poo were 7.5 to 18.3 cm. long. In the Mekong, a tributary of the Meping south of Chiengmai, the fish was found to be common in February 1932, browsing on algae growing on rocks in the clear, shallow water; many specimens preserved were 11.9 to 18.3 cm. long. The fish was also common in the Mekang, at Pang Chao, at the base Doi Angka, in December 1928.

The species is characterized by a very small head (4.4 to 5.4 in standard length), origin of dorsal fin far in advance of ventrals, all scales on upper part of body with a black basal pocket, and four black stripes on back and side posterior to the dorsal fin.

LOBOCHEILUS TRANGENSIS (Fowler)

Tylognathus trangensis FOWLER, 1939, p. 72, figs. 19, 20 (Trang).

Known only from the type, 13.7 cm. long, from a waterfall stream near Trang, in Peninsular Thailand, this species is very close to *L. quadrilineatus* (Fowler) and may prove a variant thereof. The apparent differences are a more slender form (depth 4 as against 3 to 3.8 in *L. quadrilineatus*), more depressed snout, and the presence on the caudal peduncle of a blackish blotch, which extends on the base of the median caudal rays. Several other differences mentioned by Fowler do not seem to be valid; thus, *trangensis*, instead of having a "greatly longer pectoral fin" than *L. quadrilineatus*, contained 1.25 times in head, in reality has a shorter pectoral than *quadrilineatus* of which description and figure (Fowler, 1935a) show the pectoral to be 1 to 1.12 in head; and *L. trangensis*, said to differ in having "but 4 scales below lateral line to ventral origin," in this feature agrees essentially with *quadrilineatus*, described as having four or five such scales and figured as having four.

LOBOCHEILUS CORNUTUS, new species

FIGURE 44

Description.—Depth about 3.8 in standard length; least depth of caudal peduncle about 0.5 its length and slightly less than 0.5 length of head; head 4 in length, its width at opercles slightly less than its depth and more than 0.5 its length; snout broad, blunt, its length less than half head, thickly beset with large horny tubercles occupying craterlike depressions, a deep horizontal groove on each side dividing the tubercles into groups with two rows in each group, the upper group consisting of a central part and a lateral part that extends backward as far as nostrils, the lower group reaching halfway to corner of mouth; eye small, five in head, 2.4 in snout and in the broad slightly convex interorbital space, placed in upper half of head and nearer to posterior margin of head than to tip of snout; mouth occupying full width of head, twice diameter of eye; upper lip thick, its base partly covered centrally by the pendulous rostral fold, the free edge of which is entire, superficial part of lower lip thick, ellipsoidal, anteriorly papillose, its antero-posterior diameter equal to eye, deep part of lower lip closely adherent to lower jaw, which has a prominent horny sheath; a pair of maxillary barbels less than diameter of eye; pharyngeal teeth 5,4,2–2,4,5, slender, compressed, crowded feebly uncinate, with narrow grinding surface; gill rakers short, slender, feeble, about 5+31 on first arch.

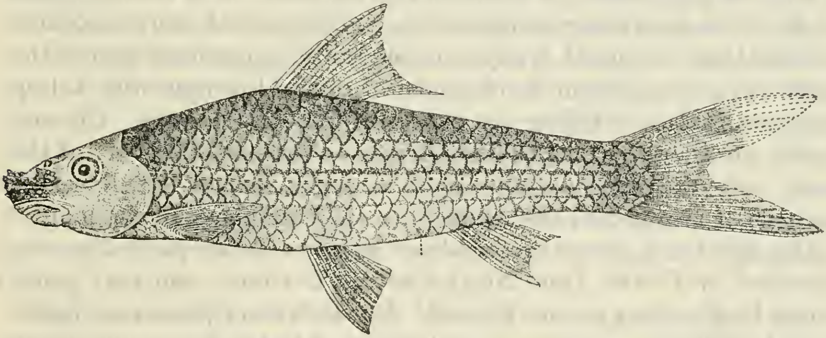


FIGURE 44.—*Lobocheilus cornutus*, new species: Type (U.S.N.M. No. 107957). Drawn by Mrs. Alice C. Mullen.

Squamation: Tubule-bearing scales in lateral line 35; scales in transverse series from midline of back to midline of abdomen 5.5–1–4, with 3.5 scales between lateral line and base of ventral fin; predorsal scales 11; rows of scales around narrowest part of caudal peduncle 16.

Fins: Origin of dorsal fin over tenth scale of lateral line, well in advance of ventrals; dorsal emarginate, rays iii,8, longest branched ray 0.9 head; caudal deeply forked, lobes pointed, longer than head; anal emarginate, rays iii,5; ventrals arising under twelfth scale of lateral line, longest ray 1.5 in head; pectorals slightly longer than ventrals.

Coloration: Silvery brown on back and sides, under parts whitish; five narrow dark brown longitudinal stripes along side posteriorly, the median stripe longest and most distinct, extending from over tip of pectoral fin to caudal base; fins plain.

Type and paratypes.—The type (U.S.N.M. No. 107957) 17.3 cm. long is a male collected by R. Havmöller in February 1929, in Klong Chawang, a mountain stream east of Bandon, Peninsular Thailand. Four other specimens with the same data in the National Museum collection are 16.3 to 20.2 cm. long, all with marked development of rostral pearl organs and all with the dorsal and anal fins having conspicuous dermal flanges. Paratypes are U.S.N.M. Nos. 108100, 109773, 117627, 117636, 119524.

Other specimens.—Other material, also collected by Mr. Havmöller, was taken in December 1929, from Klong Sok, a tributary of the Menam Tapi, Peninsular Thailand; one is a male 19.5 cm. long, with large rostral tubercles divided into upper and lower groups by a deep horizontal groove, which is continuous around the front of the snout; the other is a female 19 cm. long, with no tubercles but with small pores on the front of the snout.

Remarks.—This form is as yet known only from mountain streams in the Bandon district of Peninsular Thailand. It is distinguished chiefly by its moderately elongate form; single pair of short maxillary barbels; large, elliptical, freely movable padlike superficial part of the lower lip; and exuberant development of rostral tubercles with a deep horizontal sulcus dividing the tubercles into two groups. Characteristic are the dark longitudinal stripes on the posterior part of the body, with the middle stripe most strongly defined. Full sexual maturity is attained by the males when they are about 16 cm. long.

This fish has a general resemblance to *Lobocheilus quadrilineatus*, described by Fowler from North-Central Thailand, and may prove to be a local variety or race thereof. Fowler's description and figures indicate differences in the general shape of body, shape and size of head, shape and length of snout, and other minor characters. The present form has a less elevated back, more slender caudal peduncle, longer head, more posterior position of the eyes, together with the marked rostral sulcus, which appears to be lacking in *L. quadrilineatus*, even in specimens that are of much larger size than is known to be attained by *L. cornutus*.

LOBOCHEILUS CRYPTOPOGON (Fowler)

Tylognathus cryptopogon FOWLER, 1935a, p. 125, figs. 69, 70 (Khao Nam Poo); 1935b, p. 513 (Old Chiengsen).

Known from a few specimens, 6.8 to 10.4 cm. long, from the Khao Nam Poo, Central Thailand and the Mekong at Old Chiengsen, Northern Thailand. The dorsal fin, with a sharply defined black edge, arises well in advance of the ventrals over the ninth scale of the lateral line; the short maxillary barbels are concealed in the postlabial groove; the lower lip is coarsely fringed; the body is marked by numerous dark longitudinal lines following the rows of scales; and there are two blackish transverse bars on the caudal peduncle.

LOBOCHEILUS DAVISI (Fowler)

Tylognathus davisi Fowler, 1937, p. 208, figs. 179, 180 (Kemarat).

Known from one specimen, 7.8 cm. long, from the Mekong at Kemarat, Eastern Thailand, this species has no outstanding features. The only marks on the body are about eight indistinct dark longitudinal lines on the back and side following the rows of scales, the line above the lateral line being darker on the caudal peduncle and ending in an elongate spot.

LOBOCHEILUS RHABDOURA (Fowler)

Tylognathus rhabdoura Fowler, 1934a, p. 133, figs. 99, 100 (Chiengmai).

The writer first met with this fish in 1923 when, on November 25, a specimen 6 cm. long was taken in the Menam Chao Phya at Bang Pang, Central Thailand. He next obtained 4 specimens, 5.7 to 6.8 cm. long, on November 25, 1928, in the Meping at Chiengmai. They were brilliant silvery, with a black longitudinal stripe in the posterior part of the body ending in a blotch on the caudal peduncle. The Meping at Chiengmai yielded another specimen, 6 cm. long, on December 19, 1932. Fowler's type, 7.2 cm. long, and numerous other specimens, 3 to 6.9 cm. long, in the de Schauensee collection came from the same locality. Phya Daruphan Pithaks, chief conservator of forests in Thailand, collected specimens in the Mesoi at Lampang, Central district.

This is a slender species (depth 4.2 to 4.5 in standard length), with a pair of minute maxillary barbels, the lower lip papillate, 32 to 34 scales in the lateral line, 6 to 6.5–1–3 scales in transverse series and 10 predorsal scales.

LOBOCHEILUS CHEVEYI, new species

Figure 45

Description.—Depth of body 4.5 in standard length; least depth of caudal peduncle slightly more than 0.5 its length and 0.5 depth of body; profile from snout to dorsal fin gently arched, ventral profile less curved than dorsal; head 4.3 in length, its depth and breadth about equal; snout 2.5 in head, its anterior surface rising obliquely from the wide mouth, which extends backward to a point under nostrils, its width 1.5 times eye and slightly less than snout; upper lip smooth, lower lip with its superficial part broad, full, anteriorly beset with low papillae; a pair of maxillary barbels 0.5 eye; eye in midlength of head, 5 in head, 2 in snout, 2.5 in the strongly convex interorbital space; teeth 5,4,2; gill rakers 5+22 on first arch.

Squamation: Scales in lateral line 32 (including all that are tube-bearing), in transverse series from midline of back to ventral fin 5.5–1–3, in predorsal region 11, around narrowest part of caudal peduncle 16; ventral axillary scale about 0.3 length of first branched ray.

Fins: Dorsal arising in advance of ventrals, midway between tip of snout and posterior base of anal, over ninth scale of lateral line; dorsal rays iii,8, longest branched ray shorter than head; caudal forked, about as long as head; anal rays iii,5, longest branched ray about 1.5 in head; ventral somewhat shorter than pectorals, which are slightly shorter than head; pectoral rays i,14.

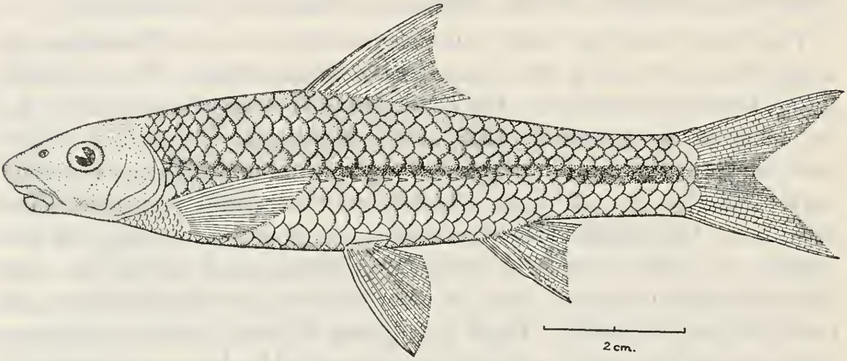


Figure 45.—*Lobocheilus cheveyi*, new species: Type (U.S.N.M. No. 107947). Drawn by Miss Jane Roller.

Coloration: Upper half of head and body dark olive, underparts whitish; a jet black median lateral band from head to base of caudal, the band anteriorly involving parts of two rows of scales and posteriorly parts of three rows; scales of body with dark edges; anterior margin of dorsal fin from base to tip black, rays greenish, membranes mostly blackish; caudal dull green, with the black lateral body band extending on median rays; other fins plain.

Type.—The type specimen (U.S.N.M. No. 107947), 12.1 cm. long, was collected by H. G. Deignan, December 25, 1936, in the Menam Mao, a tributary of the Menam Fang, Northern Thailand.

Remarks.—This form presents a combination of characters by which it appears to be distinguished from other species known from Thailand and adjacent countries. The most prominent of these characters are the comparatively few scales in the lateral and transverse series, the single pair of barbels, rather slender body, obliquely truncate snout, and distinct coloration, the lateral black band being wide and sharply defined. *L. bo*, with essentially the same squamation, has less elongate body, very different physiognomy, and no sharply defined black lateral band. *L. melanotaenia* is a deeper fish, with arched back, differently shaped snout and mouth, much shorter barbels, and entirely different coloration, the black lateral band being much narrower and each of the scales of back and sides having a dark basal crescent.

At the place of capture, at Ban Muang Sum, the Menam Mao was a clear mountain torrent. The dorsal fin exhibits a marked development of dermal flanges on the rays, characteristic of many mountain-stream cyprinoids in Thailand.

The species is named in honor of Dr. Pierre Chevey, of the Institut Oceanographique de l'Indochine, in recognition of his valuable researches on the fish fauna of French Indo-China.

LOBOCHEILUS GRACILIS (Fowler)

Tylognathus gracilis Fowler, 1937, p. 209, figs. 183, 184 (Mepoon, Kemarat).

Known from both the Menam Chao Phya and the Mekong, this species is characterized by its slender form (depth 4.5 to 4.75 in standard length); three scales between the lateral line and the ventral fin; falcate dorsal, anal, ventral, and pectoral fins; caudal fin deeply forked and 1.5 times length of head; very slender caudal peduncle, its length more than twice its least depth; and three narrow, sharply defined blackish longitudinal stripes on posterior half of body.

The numerous specimens examined were 15.3 to 23.3 cm. long. A specimen 15.5 cm. in length was taken by the writer in the Mekok at Chiengrai, Northern Thailand, March 2, 1924.

LOBOCHEILUS THAVILI, new species

Description.—Elongate, moderately compressed, depth 5 in standard length, 6.5 in length with caudal fin; least depth of caudal peduncle about 2.5 in its length and 2 in head; head small, over 5 in standard length, its width equal to its depth at posterior margin of eyes and equal to length of snout and eye; snout broad, obtusely rounded, thickly beset with large pores, which extend as far back as nostrils; eye small, 5.5 in head, 2.5 in snout, 3 in strongly convex interorbital space, its center in midlength of head; maxillary barbel shorter than eye; no rostral barbels; thick, rounded pad on lower jaw as wide as postorbital part of head.

Squamation: Scales in lateral line 33, in transverse line 5.5–1–3.5 to base of ventral, in predorsal region 10, around narrowest part of the caudal peduncle 14.

Fins: Origin of dorsal fin well in advance of ventral, over ninth scale of lateral line, midway between tip of snout and posterior end of anal base; dorsal rays iii, 8, first branched ray as long as head;

caudal fin long, 1.5 times head, deeply forked, lobes pointed; anal rays iii, 5 last unbranched ray very thick, 0.8 length of head; ventrals and pectorals subequal, shorter than head, ventrals arising under twelfth scale of lateral line, not reaching anal opening, ventral axillary scale 0.5 length of fin.

Coloration (life): Back and top of head golden brown, side and lower part silvery white; body with narrow longitudinal stripes of dark brown from head to caudal fin, nine stripes at deepest part of body, the stripes on each side of lateral line most distinct; a large dark spot on caudal peduncle near base of fin; head behind eye with rich golden reflection; dorsal and caudal fins dusky pink, a yellow-green area on base of caudal; anal, ventral, and pectoral fins pinkish white.

Type.—The type, 27 cm. long, was taken in the Meklong at Rajaburi, Central Thailand, July 29, 1923. It remains in the collection of the Thailand Bureau of Fisheries.

Remarks.—The relations of this fish to the other local species are indicated in the preceding key. The principal differential features are the very elongate form, small head, small eye, slender caudal peduncle, single minute barbel, long and deeply forked caudal fin, and coloration.

The fish seems to be known to the fishermen of the Meklong, as shown by their use of a distinctive name, *pla soi dok bua* (*dok bua*, lotus flower). The species is apparently rare, as only one specimen was obtained in the Meklong, and it has not been found elsewhere.

The species is named for Thavil Vongtongmark, a former assistant in the Siamese Bureau of Fisheries, in appreciation of his keen interest in Thai fresh-water fishes and his zeal in conservation measures.

Genus MORULIUS Hamilton

Morulius Hamilton, Fishes . . . River Ganges, p. 331, 1822. (Type, *Cyprinus morala* Hamilton.)

MORULIUS CHRYSOPHEKADION (Bleeker)

Rohita chrysophekadion Bleeker, 1850 (25), p. 20 (Surabaya, Java).

Morulius dinema Bleeker, 1865 (347), p. 35 (Siam).

Morulius chrysophekadion Bleeker, 1865 (356), p. 175 (Siam).

Labeo chrysophekadion Károli, 1882, p. 179 (Siam).—Vipulya, 1923, p. 225 (Bangkok).

Labeo (*Morulius*) *chrysophekadion* Weber and de Beaufort, 1916, vol. 3, p. 210, fig. 80 (Siam).—Chevey, 1932b, p. 34, pl. 10 (Siam).

Labeo (*Morulius*) *crysophekadon* Hora, 1923b, p. 159 (Nontaburi, Bangkok).

Morulius erythrostictus Fowler, 1934a, p. 127, figs. 85, 86 (Chiengmai).

Morulius pectoralis Fowler, 1934b, p. 346 (Bangkok).

This striking species, known from Java, Borneo, Sumatra, Cambodia, Cochinchina, and Laos, as well as from Thailand, reaches a length of 60 cm. Several specimens, 48 cm. long, taken in a canal in

Bangkok May 3, 1928, weighed 3 pounds each. In Thailand it occurs throughout the basin of the Menam Chao Phya and in various other rivers of the Central region.

An important breeding ground for this species is Bung Borapet, the large swamp communicating with the Menam Chao Phya and the Menam Nan near Paknampo which, on the writer's recommendation, was converted into a fish preserve and nursery by the Siamese Government. A series of specimens taken November 19, 1923, as the fish were leaving the swamp with the fall of the flood waters, were 7.1 to 10.5 cm. long and were undoubtedly the young of the year. Notwithstanding their small size, all had a profuse display of pearl organs on snout, top and sides of head, and on the back as far as the dorsal fin.

There is little reason to doubt that Fowler's *M. erythrostictus* is this common and widely distributed species, which shows slight variation in color depending on age and environment. Among specimens collected by the writer in different streams of Thailand, including the Ping River from which Fowler's specimens presumably came, there are examples that conform with the color features given for *M. erythrostictus.* The transverse rostral fold, which Fowler stresses as a diagnostic point, is to be seen in all specimens at hand and in some is much more strongly marked than in Fowler's figure; it is shown also in Chevey's plate of a specimen from Cambodia and in Sauvage's figure of *Rohita pectoralis*, also from Cambodia. Another feature on which Fowler separates *M. erythrostictus* from *M. chrysophekadion* is the size (and hence the number) of the scales in the predorsal area, the former being credited with "small predorsal scales." These scales in *M. erythrostictus* are stated to number 19 to 22, whereas in *M. chrysophekadion* they are given as 20 to 23 by Bleeker and "about 25" by Weber and de Beaufort—in other words, there is no essential difference in this respect. Another feature that is said to separate *M. erythrostictus* from *M. chrysophekadion* is the "much smaller scales crowded on the back along the dorsal fin base." The presence of these scales is not mentioned by Bleeker or by Weber and de Beaufort, but is obvious in all specimens of *M. chrysophekadion* from all parts of Thailand and adjacent countries.

Sauvage's *Rohita pectoralis* from Cambodia presents no valid differential characters and is assignable to *M. chrysophekadion.* Although the scales in the lateral line are said by Sauvage to number 46 to 48, his figure shows only 42 or 43, thus bringing his fish within the scope of *M. chrysophekadion*, in which the lateral-line scales are given by Bleeker and by Weber and de Beaufort as 41 to 43. Fowler, in identifying as *M. pectoralis* specimens 9.4 to 15.5 cm. long collected in Bangkok, notes that they have the free edge of the dorsal and anal fins straight, whereas Weber and de Beaufort's figure of *M. chrysophekadion* shows these fins with a concave edge. Sauvage, however, represents his species with a concave anal fin, while Bleeker's figure of *M. chrysophekadion* indicates a fish with practically straight edges to both fins, the anterior dorsal rays being somewhat extended. It is believed that no importance can be attached to the shape of the free edge of the dorsal and anal fins in this species; in the specimens at hand this feature varies with age.

The usual name given to the fish in Thai is *pla ka*, or crow fish, in allusion to its blackish color. In Cambodia, this species, on account of its violaceous or bluish-black color, together with its ability to make a raucous croak, is called *trey kaek* (crow fish), according to Chevey (1932b).

Genus LABEO Cuvier

Labeo Cuvier, Le règne animal, vol. 2, p. 194, 1817. (Type, *Cyprinus niloticus* (Forskål) Geoffroy.)

This genus, extremely well represented in India, where some of the species reach a length of 5 feet, has 11 representatives in Thailand, only one of which is at all common. A number of additional species known from Burma may be looked for in the Salwin basin in Thailand.

The eleven species known to the Thailand fauna are characterized as follows:

1*a*. Scales in lateral line 40 to 44.

2*a*. Only maxillary barbels; predorsal scales 20 -------- dyocheilus

2*b*. Both maxillary and rostral barbels.

3*a*. Predorsal scales 12; branched dorsal rays 13 to 15; general color blackish to slaty, all fins black -------- calbasu

3*a*. Predorsal scales 15; branched dorsal rays 11; light olive above, whitish below, no fins black -------- indramontri

1*b*. Scales in lateral line less than 40.

4*a*. Both maxillary and rostral barbels; rostral fold scalloped, plaited, or fringed.

5*a*. Color nearly uniform black; caudal and pectoral fins orange, other fins black -------- bicolor

5*b*. Color reddish brown; a large irregular blotch on caudal peduncle; dorsal, anal, and ventral fins black with white edge, caudal fin white. munensis

5*c*. A large black ellipsoidal spot on caudal peduncle; a black stripe from eye to end of snout.

6*a*. Origin of dorsal fin over origin of ventrals; all fins plain -------- frenatus

6*b*. Origin of dorsal fin well in advance of ventrals; caudal fin vermilion; dorsal, anal, and ventral fins with dark or black membranes. erythrurus

4*b*. Only rostral barbels; rostral fold entire -------- stigmapleura

4*c*. Only maxillary barbels; rostral fold various.

7*a*. Rostral fold entire.

8*a*. A transverse rostral groove; scales above lateral line 10.5, predorsal scales 15 to 24; rostral barbels minute in young, disappearing with age; a pair of black spots above and below lateral line over pectorals -------- behri

8*b*. No transverse rostral groove; scales above lateral line 9.5, predorsal scales 14; a pair of dark spots on caudal peduncle above and below lateral line-- cheveyi

7*b*. Rostral fold fringed; scales above lateral line 4.5, predorsal scales 10. sinkleri

LABEO DYOCHEILUS (McClelland)

Cyprinus dyocheilus McClelland, 1839, pp. 268, 330, pl. 37, fig. 1 (Bramaputra River).

Varicorhinus dyocheilus Fowler, 1935b, p. 510, figs. 4, 5 (Old Chiengsen).

This well-known Indian species, reaching a length of a meter, has been detected in Thailand waters of the Salwin basin, in the Mekong basin in Northern Thailand, and also in the Central district. It was first met with at Hangkraben, north of Ayuthia, in 1924. In a pond in Tonburi, Bangkok, connected with the Menam Chao Phya, a fish 26.3 cm. long was taken May 13, 1925, and in the same pond a specimen 27 cm. long was taken May 17, 1932, and kept alive in a tank at the office of the Siamese Bureau of Fisheries until July 14, 1932.

One of the Bangkok specimens was compared with typical examples in the Indian Museum of *L. dyocheilus* from Hardwar and Simla and found to differ somewhat therefrom in proportions, the head being larger, the snout relatively shorter and less overhanging, the eye larger, and other features that could represent individual variation. A detailed comparison of specimens from Central Thailand and India is desirable.

The fish is not common in the Bangkok region but seems to be known to the local fishermen, who call it *pla bua* (lotus fish).

LABEO CALBASU (Hamilton)

Cyprinus calbasu Hamilton, 1822, pp. 297, 387, pl. 2, fig. 33 (Bengal).

Of wide distribution in India, this species ranges to Burma, and was observed by the writer in the Salwin in both Burmese and Thailand territory in February 1932. The fish were being caught by local fishermen on baited long lines thrown from the sandy bank into the deeper parts of the river. A number of fish 40 to 50 cm. long were examined and photographed.

In India the species is reported by Day to reach a length of 90 cm.

LABEO INDRAMONTRI, new species

Figure 46

Description.—Depth 3.8 in standard length; depth of caudal peduncle 1.4 in its length and 2 in length of head; head somewhat less than 4 in length, its width over opercles less its depth and 1.7 in length; snout blunt, rounded, 2.4 in head, divided into central and lateral lobes by a deep groove extended upward and forward from postlabial commissure, anterior surface thickly beset with minute pores; free margin of snout with small, indistinct plicae; eye in midlength of head, 4 in head, 1.7 in snout, and 2 in the slightly convex interorbital space; mouth strongly arched, its width equal to eye, its posterior angle in advance of vertical from nostrils; upper lip narrow centrally, wide and thickened laterally, where it is uncovered by the rostral fold, its posterior expanded end, occupying a deep groove, bearing an irregular fringe; lower lip thick, its free margin with a row of widely spaced conical papillae and several inner rows of minute papillae, the lateral parts of the lip covered by the upper lip, the deep postlabial grooves nearly meeting centrally; a pair of minute rostral barbels and a pair of well-developed flat maxillary barbels concealed in the lateral groove; branchial openings extending to a point posterior to eyes, isthmus wider than eye; gill rakers very short, slender, and numerous.

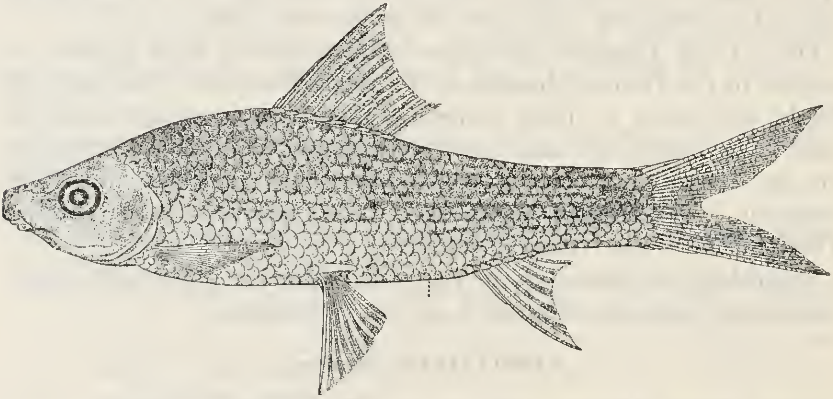


Figure 46.—*Labeo indramontri*, new species: Type (U.S.N.M. No. 107964). Drawn by Mrs. Alice C. Mullen.

Squamation: Tube-bearing scales of lateral line 43; scales in transverse series from origin of dorsal of base of ventrals 8.5–1–5; predorsal scales 15; scales around narrowest part of caudal peduncle 20.

Fins: Origin of dorsal fin over tenth scale of lateral line, midway between tip of snout and middle of base of anal fin; dorsal margin concave, its rays ii, 11, the first branched ray shorter than head; caudal longer than head, deeply forked, the lobes pointed, central rays one-third length of outer; anal rays iii, 5, the first branched ray 1.5 in head; ventrals and pectorals subequal, 1.4 in head, pectoral rays i, 14.

Coloration: Back and top of head light olive; below whitish; obscure narrow dark longitudinal stripes on back and sides following rows of scales; anterior margin of dorsal fin with a blackish line from base to tip, dorsal membranes dusky; other fins plain.

Type.—The type and only known specimen (U.S.N.M. No. 107964) is 12.4 cm. long. It was taken in Bung Borapet, Central Thailand, November 24, 1933.

Remarks.—At the time the type specimen was captured it was recognized as peculiar, and additional specimens were sought during many years. The species may be distinguished from the described Thailand and Indian species by a combination of characters, including rather small scales, two pairs of barbels, curiously papillate lower lip, and apparently small size, for the type is a female with ovaries extending the entire length of the abdominal cavity.

Named for Phya Indra Montri, for many years president of the Siam Society, in appreciation of his untiring labors in extending the knowledge of the history, culture, and natural resources of Thailand.

LABEO BICOLOR H. M. Smith

FIGURE 47

Labeo bicolor SMITH, 1931a, p. 9, fig. 4 (Menam Chao Phya).—FOWLER, 1934b, p. 347 (Silom Canal, Bangkok) ; 1937, p. 201 (Tachin River).

This was the first species of *Labeo* to be recorded from Thailand. It is known only from the Central region and its center of abundance appears to be the Menam Chao Phya basin in the region of Paknampo. It is probably the commonest fish of this genus in Thailand.

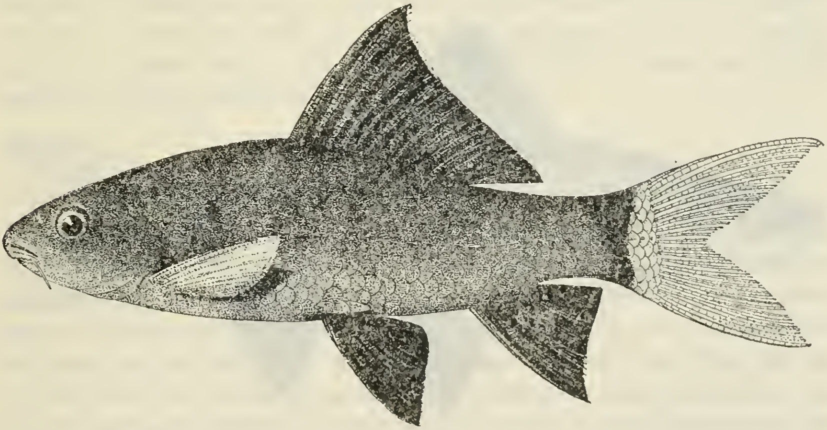


FIGURE 47.—*Labeo bicolor* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

This is a comparatively small species. The largest specimens observed have been only 12 cm. long, and full maturity is reached between 7 and 8 cm. Thus, two specimens 7.4 and 7.5 cm. long, taken in Bung Borapet, Central Thailand, March 1933, had ovaries extending as far as the base of the pectoral fins.

The specific name was applied in allusion to the nearly uniform velvety black of the body and most of the fins and the bright orange of the caudal and pectoral fins, making a very striking coloration. In alcohol and formalin the general color becomes reddish brown, and there appears on the side above the pectoral fin a round black spot, smaller than the eye, of which there was little or no evidence in life; one or two smaller black spots may sometimes appear below the other.

The vernacular name given to the fish in the upper Menam Chao Phya is *pla song kruang* (full-dress fish). Another popular name in Bung Borapet is *pla hang deng* (red-tail fish).

LABEO MUNENSIS H. M. Smith

FIGURE 48

Labeo munensis SMITH, 1934b, p. 313, pl. 12 (Menam Mun).

Although as yet known from only two small specimens from the Mun River at Tha Chang, east of Korat, Eastern Thailand, this fish appears to be familiar to the local fishermen, who know it by the distinctive name of *pla soi lord* (tubular schoolfish). The large black dorsal, anal, and ventral fins with sharply defined white edge and the long white caudal fin serve to make the recognition of this species easy.

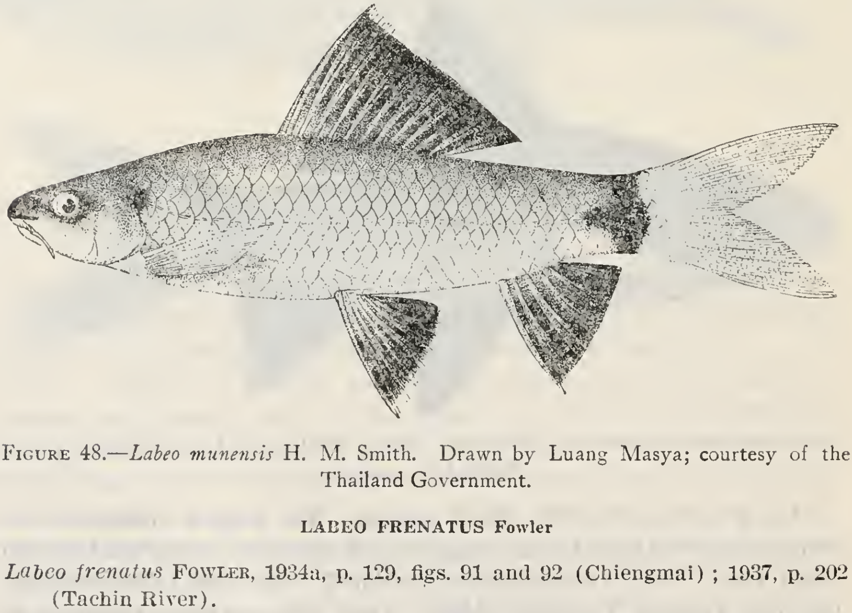


FIGURE 48.—*Labeo munensis* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

LABEO FRENATUS Fowler

Labeo frenatus FOWLER, 1934a, p. 129, figs. 91 and 92 (Chiengmai); 1937, p. 202 (Tachin River).

This species, described from specimens up to 5.7 cm. long presumably from the Meping at Chiengmai, has been reported also from the Tachin from two specimens 6 and 6.8 cm. long. There are two well-developed barbels, scalloped lips, 31 to 33 scales in lateral line, and striking coloration: a broad black band from end of snout through eye to posterior end of head and a large black ellipsoid spot across caudal peduncle.

The possibility of this being the young of *L. erythrurus* is to be considered.

LABEO ERYTHRURUS Fowler

Labeo erythrura FOWLER, 1937, p. 204, figs. 171, 172 (Kemarat).

This species, recorded from the Mekong at Kemarat, has well-developed rostral and maxillary barbels, rostral fold with about 16 plaits, a blackish band extending horizontally from eye toward end of snout, and a large black ellipsoid spot extending entirely across the caudal peduncle.

The known examples are 10.3 and 11.9 cm. long.

The possibility that this form may be the adult of *Labeo frenatus* is suggested by the general agreement in squamation, fin rays, and coloration. Differences indicated by the published descriptions are in the number of gill rakers and pharyngeal teeth, but until the limits of variation in each form are established the differences are without significance. A possible point of distinction, which may be due to the size of the specimens, is that the origin of the dorsal fin in *L. erythrurus* is well in advance of ventrals and midway between tip of snout and base of anal fin, while in *L. frenatus* the dorsal origin is directly over the ventral origin and midway between tip of snout and mid-length of caudal peduncle.

LABEO STIGMAPLEURA Fowler

Labeo stigmapleura FOWLER, 1937, p. 202, figs. 169, 170 (Kemarat, Bangkok).

Characterized by a single pair of short barbels (rostral), entire lips, 36 or 37 scales in the lateral line, 7 scales between the lateral and the origin of the dorsal fin, and a cluster of small black spots involving four or five scales on and below the lateral line above the pectoral fin, this species, described from specimens 5 to 11.5 cm. long, is reported from the Mekong at Kemarat and also from Bangkok. A sharply defined black stripe on the back at the base of the dorsal fin is shown in Fowler's figure but it is not referred to in the description.

LABEO BEHRI Fowler

Labeo behri FOWLER, 1937, p. 206, figs. 175, 176 (Kemarat, Bangkok).

This species is known only from the Mekong, with the exception of a single specimen, 6.5 cm. long, ascribed to Bangkok.

The type was 20.8 cm. long.

The fish has a peculiar physiognomy, with a groove across the snout on level with the eyes, minute rostral barbels disappearing with age, maxillary barbels small and concealed, lower lip fringed and upper lip entire, 10 scales above lateral line, 15 to 24 predorsal scales, a black spot on either side of lateral line above pectoral fin, and a dark bar across caudal peduncle near base of caudal fin.

LABEO CHEVEYI Fowler

Labeo cheveyi Fowler, 1937, p. 205, figs. 173, 174 (Mepoon).

Known from 6 specimens, 15.4 to 18.2 cm. long, from the Mepoon, in Central Thailand, this species is described as having a very short pair of maxillary barbels, broad, fleshy lips, 38 to 43 scales in the lateral line, and a pair of dark spots on either side of the lateral line near the base of the caudal fin.

LABEO SINKLERI Fowler

Labeo sinkleri Fowler, 1934a, p. 130, figs. 93, 94 (Metang).

Known only from the Metang, north of Chiengmai in Northern Thailand, this species, with a maximum recorded length of 10 cm., is distinguished by a dark vertical bar on the caudal peduncle near the base of the caudal fin, a short maxillary barbel, finely fringed lower lip, 25 gill rakers on the long arm of the first arch, 33 or 34 scales in the lateral line, and 4 rows of scales between the lateral line and the origin of the dorsal fin.

HENICORHYNCHUS, new genus

Elongate, compressed; rostrum produced as a thin flap that centrally overlaps the upper lip but laterally recedes, exposing the outer parts of the lip and the corners of the mouth; edge of flap finely crenulate and incised in the middle; upper and lower lips continuous; lower lip thin, papillate, rather closely adnate to jaw, with no inner transverse fold, its median part continuous with the skin of the isthmus, each lateral part with a short, posterior groove; lower jaw with a trenchant edge; no rostral barbels; a pair of short maxillary barbels (sometimes not evident) concealed in groove behind labial commissure; a deep groove at side of mouth extending on rostrum and dividing it into a central and two lateral parts; rostral pores; eye with a narrow circular adipose rim; gill openings extending well forward, gill membranes joined to narrow isthmus; gill rakers slender, numerous; pharyngeal teeth triserial; scales in moderate number; lateral line complete; dorsal fin with 8 branched rays, the last simple ray nonosseous or very slightly osseous; branched anal rays 5.

Genotype.—Henicorhynchus lobatus, new species.

This genus is proposed for certain small Thai fishes that do not seem to fall within the limits of already established genera. It resembles *Tylognathus* in general appearance and in characters including free edge of rostrum covering base of upper lip, continuous lips, trenchant lower jaw, barbels, squamation, and fin rays, but differs in having the edge of the rostrum crenulated and medianly incised, in having no fleshy superficial padlike part of lower lip, in having a deep postlabial groove that almost cuts off the outer segment of each side of the lower lip, and in the division of the snout into central and lateral parts by a deep groove, which extends upward and forward from the side of the mouth.

Resemblance to *Labeo* is in the general mouth structure, but difference is seen in the median division of the thin crenulated rostral flap, in the bilobed shape of the flap, in the lower lip closely adnate to the lower jaw, and in the absence of inner transverse labial folds.

HENICORHYNCHUS LOBATUS, new species

Figure 49

Description.—Form elongate and moderately compressed; dorsal and ventral profiles similar; depth 3.5 in standard length; least depth of caudal peduncle 1.5 in its length and about 2 in head; head 4.3 in length; eye 3.8 in head, 1.2 in snout, and 1.6 in the broadly convex interorbital space, a narrow circular orbital rim best developed anteriorly; snout broadly rounded, 3 in head; nostrils large, in horizontal line with upper edge of pupil; mouth wide, horizontal, lips thin and continuous; upper lip medianly covered by a rostral flap, whose surface is finely papillate, its edge crenulate and divided by a deep emargination into two rounded lobes; lower lip very thin and closely adnate to jaw, its central part continuous with skin of isthmus, its lateral parts with a postlabial groove, which almost completely separates them from the center; lower jaw with a broad, thin trenchant edge; a deep groove on each side of mouth extending from behind labial commissure upward and forward to a point on snout opposite pupil, forming a well-marked central lobe; a concealed barbel, 0.25 diameter of eye, behind the commissure; branchial aperture wide, extending forward to a point under posterior border of eye; branchial membranes joined to the narrow isthmus; gill rakers short, slender, about 5+29 on first arch; pharyngeal teeth 5, 4, 2, long, close-set, with broad grinding surface.

Squamation: Scales in lateral line 35, in transverse line 14 from midline of back to midline of abdomen, 5 between lateral line and base of ventral fin, 9 predorsal, 20 circumpeduncular; lateral line gently decurved in first fourth of its length, thence running nearly straight to midcaudal base.

Fins: Dorsal rays ii, 8, first branched ray somewhat longer than head, last simple ray slender and scarcely or not at all osseous, free edge of fin concave; origin of dorsal fin well in advance of ventrals, over ninth scale of lateral line and much nearer to tip of snout than to base of caudal fin; caudal deeply forked, 1.4 times length of head; anal rays iii, 5, longest 1.5 in head; ventrals 1.25 in head; pectorals pointed, 0.8 head.

Coloration: Back and sides greenish, with faint darker longitudinal lines following the rows of scales; underparts whitish; interradial dorsal membranes medianly blackish, free margin of dorsal fin with a narrow sharply defined black edge.

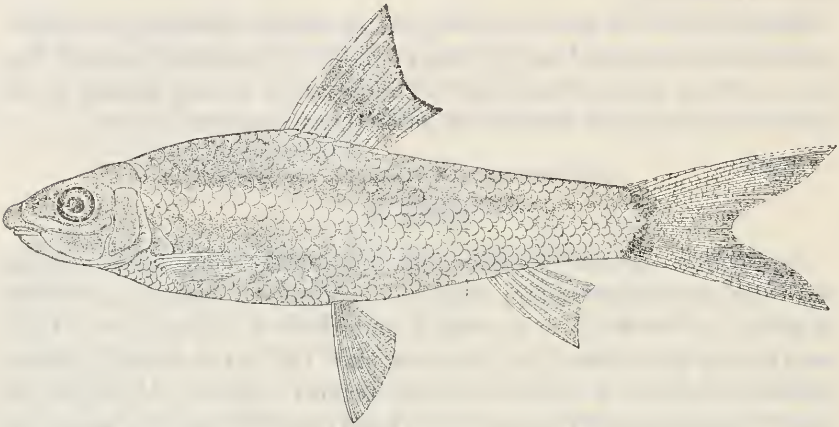


FIGURE 49.—*Henicorhynchus lobatus*, new species: Type (U.S.N.M. No. 119490). Drawn by Mrs. Alice C. Mullen.

Type and other specimens.—The type (U.S.N.M. No. 119490), a female 13.2 cm. long, was collected in the Mekok near Chiengrai, Northern Thailand, March 2, 1924. A male 14.2 cm. long was taken at the same time. Additional specimens have come from the Menam Pasak at the barrage at Dha Luang, August 20, 1923; from the Menam Chao Phya at Paknampo November 19, 1923; from Bung Borapet November 20, 1923 (3 specimens 9.1, 11.7, and 12.6 cm. long); and from the Menam Chao Phya at Bangsai November 27, 1923. In the Deignan collection are 28 specimens, 5.9 to 10.6 cm. long, from the upper Nan River at Ban Pa Khwang, Northern Thailand, March 31, 1936. Paratypes are U.S.N M. Nos. 108091, 119491–119494.

Remarks.—From the foregoing record of specimens in hand it appears that this species has a rather wide range, involving both the Mekong and the Menam Chao Phya basins.

A feature by which the species may be recognized readily is the deep median incision in the rostral flap dividing it into two lobes and the evenly crenulated edge of the lobes, together with the indicated structure of the lower lip and the division of the snout into central and lateral lobes. Specimens 7.8 to 9.3 cm. long, believed to be young of the year, show a small roundish black spot on the caudal peduncle at the base of the caudal fin. This spot seems to be entirely lost by the time the adult stage is reached.

Subfamily GARRINAE

Under this subfamily name (based on the oldest generic name) there may be grouped a few genera with local representatives in which an outstanding character is the coalescence of the upper lip with the skin of the rostrum. The paired fins are for the most part horizontal; in some of the genera the lower lip is modified into a sucking disk, and the mouth is distinctly inferior. The genera of this subfamily, two of which are peculiar to Thailand, may be differentiated as follows:

1*a*. Upper and lower lips continuous; lower lip modified into a circular or elliptical sucking disk; snout bearing horny tubercles; branched dorsal rays 7 to 9.
  2*a*. Edges of sucking disk free and papillate; upper lip crenulated; 2 or no rostral barbels, 2 maxillary barbels which may be vestigial or absent; simple dorsal rays may be partly ossified ---------------------- Garra
  2*b*. Edges of sucking disk free and entire; upper lip entire; 2 rostral and 2 maxillary barbels well developed; simple dorsal rays nonosseous. Discolabeo
1*b*. Upper and lower lips not continuous; lower lip not modified into a sucking disk; upper lip crenulated or fringed; snout with or without horny tubercles; branched dorsal rays 8 or 10; simple dorsal rays nonosseous.
  3*a*. Branched dorsal rays 8.
    4*a*. Body subcylindrical; snout with a small, movable lateral lobe; no rostral pores or tubercles; upper and lower lips connected by a frenulum; barbels rostral and maxillary or only rostral ------ Epalzeorhynchos
    4*b*. Body compressed; snout with no lateral lobe; rostral pores and tubercles present; lips not connected, upper lip joined to lower jaw by a frenulum; barbels rostral and maxillary, but either pair may be absent -- Crossocheilus
  3*b*. Branched dorsal rays 10; body compressed; rostral pores and tubercles present; lips not connected, upper lip joined to lower jaw by a frenulum; no barbels -- Mekongina

Genus GARRA Hamilton

Garra Hamilton, Fishes . . . River Ganges, 1822, p. 393. (Type, *Cyprinus lamta* Hamilton.)

The fishes of this genus are found mostly in mountain streams, where they are aided in maintaining their position by means of a small sucking disk on the lower lip that enables them to adhere to stones. The genus, called *Discognathus* (Heckel, 1843) by Günther, Day, Weber and de Beaufort, and other authors, occurs in Africa, Syria, Arabia, Burma, Ceylon, and Borneo, as well as in Thailand.

Four local species may be recognized as follows:

1*a*. One pair of barbels (rostral); a broad black lateral band from head to base of caudal fin.
  2*a*. Caudal peduncle rather long, equal to or longer than head and 1.5 to 2 times its depth.

3*a*. Dorsal fin with 2 broad black cross bands separated by a yellow median band; caudal lobes plain------------------------------------ taeniata

3*b*. Dorsal fin with no broad black cross bands; each caudal lobe with a narrow black sharply defined submarginal stripe-------- fasciacauda

2*b*. Caudal peduncle much shorter than head, its length equal to its least depth --- parvifilum

1*b*. Two pairs of barbels (rostral and maxillary); coloration of body plain. fuliginosa

GARRA TAENIATA H. M. Smith

FIGURE 50

Garra taeniata SMITH, 1931a, p. 19, pl. 1 (Tadi Stream, Nakon Sritamarat).—FOWLER, 1934a, p. 138, fig. 107 (Chantabun, Nakon Sritamarat).—KOUMANS, 1937a, p. 63 (Peninsular Siam).

Garra spinosa FOWLER, 1934a, p. 138, figs. 104–106 (Metang River north of Chieng Mai).

Garra taeniatops FOWLER, 1935a, p. 129, figs. 75–77 (Khao Nam Poo); 1937, p. 211 (Mepoon).

Originally described from Tadi Stream, Nakon Sritamarat, from two specimens taken in July 1928, this species has since been found to be widely distributed, not only in the Peninsula but also Central, Northern, Eastern, and Southeastern Thailand.

A length of 15 cm. is attained, but full sexual maturity is reached at less than half that size.

The development of tubercles on the snout and of pearl organs on head and body is marked in both sexes, but is more pronounced in the males. Other secondary sexual characters are the length of the anal fin and the length of the barbels.

Among numerous specimens taken by Deignan in tributaries of the Nan River in Northern Thailand in June 1936, the largest in one lot are two females, 5.8 and 6 cm. long, with nearly ripe eggs, the ovaries extending as far forward as the base of the pectoral fins, and two males, 6.1 and 6.9 cm. long; the prickliness of the rostral tubercles is much greater in the males; and the depressed anal fin reaches the caudal rays in some of the males but in none of the females. In another lot, two females, 6.8 and 7.7 cm. long, with well-developed ova, have every scale on the body as well as the upper entire part of the head thickly beset with minute pearl organs.

It is believed that *Garra spinosa* Fowler, described from numerous specimens, 3.4 to 9 cm. long, from several localities in Northern Thailand, is the present species. The principal characters ascribed to the species were: 29 to 31 scales in the lateral line, rostral barbel as long as eye, large pearl organs on snout and smaller ones covering upper surface of head and predorsal region, a broad dark band along the side from head to caudal fin, and dorsal fin variously banded according to size of specimen. According to Fowler, from *G. taeniata* it "apparently differs in smaller scales, that species with 35 scales in its lateral line, longer barbels, fewer and differently arranged pearl organs on the snout with apparently no smaller ones over the predorsal region and less brilliant colors." These differences do not seem to be of specific value and may be regarded as falling within the limits of normal variation in *G. taeniata.*

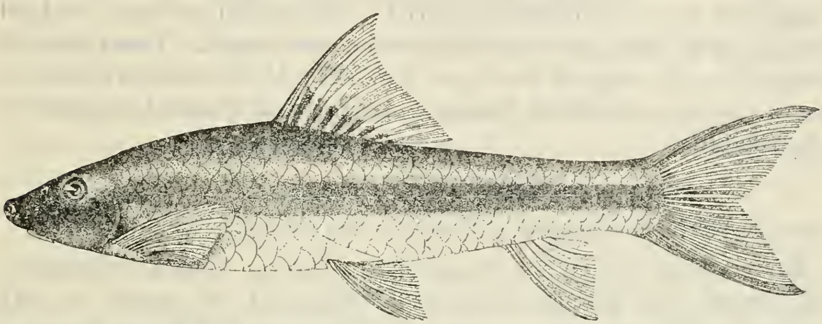


FIGURE 50.—*Garra taeniata* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

It is the present author's opinion that *Garra taeniatops* Fowler, described from specimens 3.3 to 5 cm. long, is the young of *G. taeniata.* The differences (in number and size of pearl organs, length of rostral barbels, size of anal fin, and color of the margin of the dorsal fin) pointed out by Fowler are believed to be due to age, sex, or individual variation. In essential characters there is agreement. Specimens 7.6 and 9.4 cm. long from the Menam Fang, a tributary of the Mekong, agree with Fowler's description in having the rostral barbel shorter than the eye and the dorsal fin with a whitish margin, but the depressed anal fin does not reach the caudal base. Five paratypes of *G. taeniatops*, 3.7 to 4.1 cm. long are in the U. S. National Museum through exchange with the Academy of Natural Sciences of Philadelphia; in none is there evidence of maturity of the sex glands but in several pearl organs are conspicuous on the snout and in one the top of the head as far back as the nape is thickly beset with minute pearl organs; the depressed anal fin either just reaches or does not quite reach the lower basal elements of the caudal fin; in one specimen the distal dark band on the dorsal fin extends to the free edge of the fin, but in the others the edge is white; and tube-bearing scales in the lateral line number 32 to 34 (in this respect agreeing with undoubted specimens of *G. taeniata* in which the lateral-line scales vary from 32 to 35).

In Peninsular Thailand the vernacular name of this fish is *pla lia hin* (stone-lapping fish).

GARRA FASCIACAUDA Fowler

Garra fasciacauda Fowler, 1937, p. 212, figs. 187, 188 (Kemarat).

Known from numerous specimens, 7.5 to 11 cm. long, from the Mekong at Kemarat, Eastern Thailand, this species is conspicuously marked by a narrow sharply defined black submarginal stripe extending nearly the full length of each caudal lobe, in addition to a broad black band along the middle of the side. The fish is rather slender (depth 5.2 to 5.3 in standard length). The caudal peduncle is about as long as the head and 1.5 to 2 times its own length. From 16 to 20 plaits form the edge of the upper lip. The U. S. National Museum has 2 specimens received from the Academy of Natural Sciences of Philadelphia.

GARRA PARVIFILUM Fowler

Garra parvifilum Fowler, 1939, p. 73, figs. 21, 22 (Trang).

Known from several specimens, 11.7 to 14.4 cm. long, from a waterfall stream near Trang in Peninsular Thailand, this species is very similar to *G. taeniata* in coloration but appears to differ in having a somewhat broader, more rounded snout that is shorter in its preoral aspect, and in having a much shorter caudal peduncle whose length scarcely exceeds its depth. The rostral barbels (referred to in the description as maxillary) are shorter than the diameter of the eye, while in typical *G. taeniata* they are much longer, but this appears to be a variable character in that species, and examples are met with in which the barbels are shorter than the eye.

GARRA FULIGINOSA Fowler

Garra fuliginosa Fowler, 1934a, p. 139, figs. 108–11 (Metang).

The type of this species, the only specimen known, was taken in the Metang, north of Chiengmai, Northern Thailand, in January 1933; it is 17.8 cm. long. The oustanding specific features are the possession of two pairs of barbels, a deep transverse rostral groove, and plain coloration.

Genus DISCOLABEO Fowler

Discolabeo Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 210, 1937. (Type, *Discolabeo fisheri* Fowler.)

The genus *Discolabeo*, as described and figured by Fowler, differs from *Garra* in having an entire, instead of a crenulated, upper lip and the disk is not margined with a continuous band of papillae. The position of the eye, entirely in the anterior half of the head, seems to be another differential feature. In other respects *Discolabeo* closely resembles *Garra*.

DISCOLABEO FISHERI Fowler

Discolabeo fisheri Fowler, 1937, p. 210, figs. 177, 178 (Tachin).

This species was described and known only from two specimens, 42 and 43 mm. long, from the Tachin River, Central Thailand.

Although said by Fowler to be allied to *Tylognathus*, it seems closer to *Garra*, as *Tylognathus* has no mandibular sucking disk.

Genus EPALZEORHYNCHOS Bleeker

Epalzeorhynchos Bleeker (136), Nat. Tijdschr. Nederl. Indië, vol. 9, pp. 258, 270. (Type, *Barbus kalopterus* Bleeker.)

This well-differentiated genus is characterized by an elongate, cylindrical form; small, conical head; overhanging snout with a small movable lateral lobe; skin of rostrum continuous with upper lip, which is fringed and covers the oral orifice when the mouth is closed; lips connected by a frenum at the corners of the mouth; one or two pairs of barbels; narrow, subvertical gill openings, gill membranes broadly joined to isthmus; pharyngeal teeth in three rows; short dorsal fin without osseous rays, beginning in advance of the midlength; anal fin with five branched rays; ventral fins inserted under the dorsal, and other features. The five known species, all occurring in Thailand and two herein described as new, may be distinguished as follows:

1*a*. Two rostral and 2 maxillary barbels.
  2*a*. Scales (tube-bearing) in lateral line 34 to 36, in transverse series 5.5–1–6.5; a dark brown longitudinal band from snout to end of middle caudal rays, separated from dark back by a narrow whitish streak; dorsal, anal, and ventral fins with a broad black median band________________ kalopterus
  2*b*. Scales (tube-bearing) in lateral line 28, in transverse series 4.5–1–4.5; reddish brown above; an obscure dark brown band extending from midlength of body to caudal peduncle; a sharply defined round black spot on caudal peduncle and a curved black stripe across base of caudal fin, these markings occupying a light area, the posterior part of the caudal fin being pale yellow; middle of back from head to caudal fin with a narrow brown band; no black band on anal and ventral fins, median part of dorsal membranes blackish__________________ kalliurus
1*b*. Two rostral barbels, no maxillary barbels; dorsal, anal, and ventral fins with no black band.
  3*a*. Rows of scales around narrowest part of caudal peduncle 16.
    4*a*. Body marked with a sharply defined black longitudinal band__ siamensis
    4*b*. Body marked with a large round black spot on caudal peduncle__ coatesi
  3*b*. Rows of scales around narrowest part of caudal peduncle 14; body marked with numerous small, irregular black flecks_________________ stigmaeus

EPALZEORHYNCHOS KALOPTERUS (Bleeker)

Barbus kalopterus Bleeker, 1851 (26), p. 13 (Bandjermassing, Borneo).

While this species was reported by Bleeker to be not rare in rivers of Sumatra and Borneo, it appears to be a fish of great rarity and very circumscribed range in Thailand. It is in fact known from only two specimens, 11.7 and 14.5 cm. long, collected by R. Havmöller in Klong Sok, one of the headwaters of the Tapi River, southwest of Bandon, Peninsular Thailand, in December 1929. In these examples the brown longitudinal band, dark back, and black areas on the dorsal, anal, and ventral fins were sharply defined; the larger fish had the snout thickly beset with minute prickly tubercles, while in the smaller fish the tubercles were lower and not prickly. The sharp line of demarcation between the snout and the upper lip shown in Weber and de Beaufort's figure of this species is absent in these specimens.

EPALZEORHYNCHOS KALLIURUS, new species

Figure 51

Description.—Moderately compressed; depth of body 4.4 in standard length, 5.7 in length with caudal fin; least depth of caudal peduncle 1.5 in its length and 2 in length of head; snout about 3 in head, slightly longer than eye; eye 1.3 in interorbital space; a moderately wide free orbital margin; barbels short, rather stout, rostral barbel reaching beyond edge of upper lip and rather more than 0.5 eye, maxilliary barbel less than 0.5 rostral; upper lip with 14 plicae, each terminating in a free point.

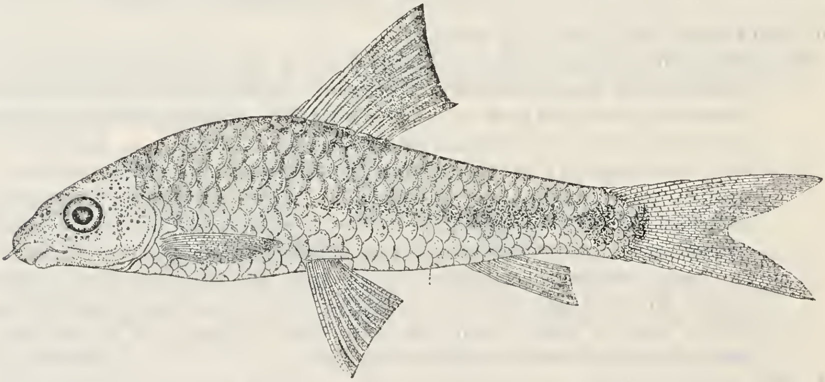


Figure 51.—*Epalzeorhynchos kalliurus*, new species: Type (U.S.N.M. No. 109764). Drawn by Mrs. Alice C. Mullen.

Squamation: Tube-bearing scales in lateral line 28, tubes deficient on the black peduncular spot; scales in transverse series from midline of back to midline of abdomen 4.5–1–4.5, with 3 scales between lateral line and origin of ventral fin; predorsal scales 10; circumpeduncular scales 16.

Fins: Dorsal origin much nearer to tip of snout than to base of caudal, over tenth scale of lateral line; margin of fin concave; dorsal rays iii,8, first branched ray slightly longer than head; caudal longer than head, forked for about 0.5 its length, the lobes pointed; anal rays iii,5, longest branched ray 1.4 in head; ventral and pectoral equal, shorter than head, ventral origin under twelfth scale of lateral line, pectoral extending to ventral base.

Coloration: Upper parts reddish brown, most of the scales of back and sides with darker base; underparts whitish; an obscure dark brown lateral band beginning about midlength of body and extending on caudal peduncle, becoming wider posteriorly; middle of back from head to caudal fin with a narrow well-defined brown band; a sharply defined black spot about size of eye on caudal peduncle occupying a whitish area that extends across peduncle but stops before reaching midline of back, the black spot bordered posteriorly by a narrow whitish area that precedes a narrow curved black stripe across the base of the caudal fin; tips of dorsal rays blackish, median part of dorsal fin with blackish membranes forming an indistinct cross bar; all other fins plain.

Type.—The type and only known specimen (U.S.N.M. No. 109764) 6.2 cm. long was taken by H. G. Deignan in the Mekong at Chiengsen Kao, Northern Thailand, January 13, 1927.

Remarks.—This species is easily recognized by its 2 pairs of barbels and its peculiar pattern of coloration. The only other species of *Epalzeorhynchos* with 2 pairs of barbels is *E. kalopterus* which, in addition to differences in scales (34 to 36 tube-bearing in lateral line and 5.5–1–6.5 in transverse line), has a broad dark band from tip of snout to posterior end of median caudal rays and broad black bands on dorsal, anal, and ventral fins.

EPALZEORHYNCHOS SIAMENSIS H. M. Smith

FIGURE 52

Epalzeorhynchos siamensis SMITH, 1931a, p. 20, fig. 9 (Tadi Stream, Nakon Sritamarat).

Herre and Myers (1937) have recorded this rare species from the Malay Peninsula in the States of Malacca, Pahang, Negri Sembilan, and Perak; their four specimens were 3.7 to 9 cm. long.

Using a dip net in the upper reaches of the Tadi River, a mountain rivulet flowing into the Gulf of Siam through the town of Nakon Sritamarat, Peninsular Thailand, the writer caught a single example of this fish on July 14, 1928. Further collecting throughout the upper part of this stream during a period of 2 weeks failed to yield other specimens, and the conclusion is probably justified that the fish is very rare.

Collecting in the Salwin at Ta Ta Fang, Western Thailand, in October, 1936, H. G. Deignan obtained a single specimen of this fish 5.1 cm. long with a well-defined narrow blackish stripe along the side from head to caudal fin and with the fins unmarked.

Although lacking the striking markings of the fins in *E. kalopterus*, this species has very attractive living colors: Back and sides green, with flecks of light blue or purple; top of head bright green; lateral band from head to tip of middle caudal rays black, with a silvery band below; underparts white; dorsal, caudal, and pectoral fins very pale green, anal and ventral fins hyaline. The type specimen had its snout, top of head, and upper lip thickly beset with low papillae.

The local fishermen give it a name, *pla lab mue nang* (lady's fingernail fish), borne by no other fish, say it is good to eat and that it gets no larger than the type, which is 13.8 cm. long.

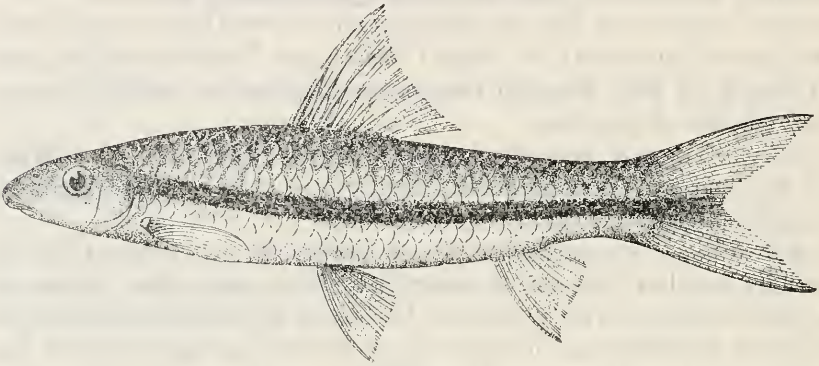


FIGURE 52.—*Epalzeorhynchos siamensis* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

EPALZEORHYNCHOS COATESI (Fowler)

Tylognathus coatesi FOWLER, 1937, p. 208, figs. 181, 182 (Bangkok); 1939, p. 72 (Trang).

This species was first observed in Thailand in November 1923 when four specimens were obtained in Bung Borapet. In 1926, 1927, and 1934 it was taken at several points in the Menam Mun both east and west of Korat, and in 1929 a specimen was secured at Pong, on the Pong River, a tributary of the Mun. In 1925 the fish was collected in Lam Tong Lang, northwest of Pakjong, and in 1927 R. Havmöller sent in specimens from Klong Chawang, near Kao Nong, in Peninsular Thailand. The Deignan collection contains specimens from the Menam Nan. The fish is thus of wide distribution but does not appear to be common anywhere.

The type, *Tylognathus coatesi*, was characterized as having, among other characters, a pair of rostral barbels and no maxillary barbels (a feature apparently not known in any species of *Tylognathus*), upper lip continuous with the rostrum and having 16 plicae forming a fringe, together with a nearly plain coloration except for a large round well-defined black spot on the caudal peduncle immediately anterior to the caudal fin. A feature not brought out in the description and figures but subsequently determined by Fowler is the presence of a deep groove extending from the corner of the mouth obliquely on the snout connecting with a shorter groove in which the rostral barbel rests, and between the grooves a short, pointed lobe.

The specimens from the Menam Nun June 5, 1934, and July 19, 1925, contained well-developed eggs and showed minute pearl organs thickly covering the top of the head and snout. The fishes were in company with *Garra* and *Gyrinocheilus*.

The type was 8.3 cm. long. The maximum size represented by the material now in hand is about 14 cm.

While it is possible that *E. coatesi* represents the female of *E. siamensis* this point cannot be fully decided with the material now available for examination. The fish appears to be definitely an *Epalzeorhynchos*, differing from *E. siamensis* chiefly in coloration.

Life colors of a specimen of *E. coatesi* from the Menam Mun November 11, 1926: Back and sides light green, the scales with dark edges, belly white; a large round black spot on caudal peduncle and a vague dark lateral band extending forward from the spot; caudal, anal, ventral, and pectoral fins whitish; dorsal rays yellow, membranes blackish.

Life colors of specimens from the Menam Mun February 15, 1927: General color light green, the scales of back and sides with dark base and silvery edge; a large round black spot on caudal peduncle; top of head gray-green; belly white; all fins light yellowish green.

In the Korat region this fish has a distinctive vernacular name, *pla soi dok yarng.*

EPALZEORHYNCHOS STIGMAEUS, new species

FIGURE 53

Description.—Depth 4.3 in standard length, 5.3 in length with caudal fin; depth of caudal peduncle 2 in its length and in head; head 4.5 in standard length; eye 4.3 in head, 1.8 in snout, 2 in interorbital space; snout 2.5 in head; 2 rostral barbels, rather stout, 0.5 eye; upper lip with about 15 well-differentiated plicae covered with minute papillae and having a free margin; no line of demarcation between snout and upper lip; top of head covered with minute tubercles.

Squamation: Scales in lateral line 31 or 32; scales in transverse line from midline of back in front of dorsal fin to base of ventral fin 4.5–1–3, with 2.5 additional scales to midline of abdomen; scales in predorsal region 10 or 11; scales around narrowest part of caudal peduncle 14.

Fins: Dorsal rays, ii,8; anterior rays elongated, giving fin a somewhat falcate appearance, longest rays equal to head; origin of dorsal fin in advance of ventrals, much nearer to tip of snout than to base of caudal fin, over tenth scale of lateral line; caudal longer than head, deeply forked lobes pointed, upper lobe longer; anal falcate, rays ii,5, longest 0.75 head; ventrals i,8, broad, 0.8 head; pectorals, i,14, as long as head.

Coloration: General color golden brown, silvery white below; top of head pale green; numerous scales on back and on side nearly as low as base of ventrals with a black basal spot, these spots along lateral line having a tendency to form a band posteriorly; all fins pale yellowish green, some of the dorsal rays and membranes dusky.

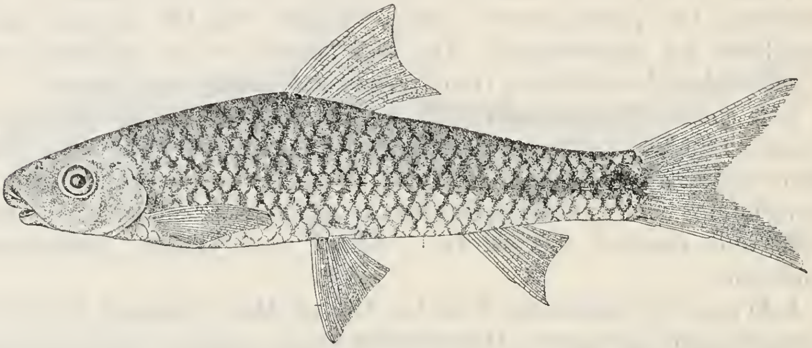


FIGURE 53. *Epalzeorhynchos stigmaeus*, new species: Type (U.S.N.M. No. 109765). Drawn by Mrs. Alice C. Mullen.

Type and paratype.—The type (U.S.N.M. No. 109765), 12.5 cm. long, and a paratype (U.S.N.M. No. 109763) and only other specimen available, 11.4 cm. long, were taken February 2, 1932, in the Mekhan, a tributary of the Meping, Northern Thailand.

Remarks.—The Mekhan at the point where this species was found is a clear cool stream flowing swiftly over gravel and shelving rocks. Other fishes inhabiting the same stretch of river were *Crossocheilus* sp. and *Gyrinocheilus* sp.

The dermal flanges on the dorsal rays, found in various genera and many species of Thai mountain-stream fishes, are very well developed in this species.

The relations of this species to the other members of the genus are shown in the preceding key. The closest resemblance is to *E. coatesi* in which there is a large, well-defined round black spot on the caudal peduncle, as distinguished from the numerous irregular black flecks on the back and sides in *E. stigmaeus.* The caudal peduncle in *E. coatesi* is relatively wider and has 16 scales around its narrowest part, as compared with 14 in *stigmaeus*, and there are various minor features in which the two forms differ.

Genus CROSSOCHEILUS van Hasselt

Crossocheilus VAN HASSELT, Alg. Konst. Letterbode, vol. 2, p. 132, 1823. (Type, *Crossocheilus oblongus* van Hasselt.)

In this genus of small fishes of the Indo-Australian Archipelago and southern Asia, the principal characters are the continuation of the skin of the rostrum as the upper lip, the nonjunction of the upper and lower lips, the connection of the upper lip with the lower jaw by a frenum, the presence of a pair of rostral or maxillary barbels (in Thai species), and the dorsal fin with eight branched rays and the last simple ray nonosseous.

One species has been known from Thailand from an early date from the collection of Mouhot. Another was added by the writer in 1928. More recently Fowler has described several other species from Thailand waters. The species of *Crossocheilus* may be differentiated as follows:

- 1*a*. Two rostral and 2 maxillary barbels.
  - 2*a*. Upper lip fringed or plaited; 2 rostral barbels.
    - 3*a*. Depth 4.5 to 5; a dark longitudinal band from head to caudal fin; no black bar behind gill opening ---- oblongus
    - 3*b*. Depth 3.8 to 4.25; a black bar behind gill opening.
      - 4*a*. A blackish longitudinal band on posterior part of body, this expanding into an elongated blotch on caudal peduncle ---- tchangi
      - 4*b*. No black longitudinal band on body; scales of back and sides edged with dark brown, forming a network; a black blotch entirely across caudal peduncle at base of caudal fin ---- reticulatus
  - 2*b*. Upper lip entire.
    - 5*a*. Two rostral barbels; scales in lateral line 35 to 38; body marked by numerous longitudinal dark lines following the rows of scales; fins plain ---- reba
    - 5*b*. Two maxillary barbels; scales in lateral line 34 or 35; body without longitudinal dark lines; dorsal fin with a broad black median band and a narrow dark edge, caudal fin with small scattered brown spots on each lobe ---- caudiguttatus
- 1*b*. Only 2 barbels, either rostral or maxillary; a broad silvery lateral band through which there may run a dark streak; a round black spot at end of lateral line on both caudal peduncle and caudal fin ---- cobitis

CROSSOCHEILUS OBLONGUS (Cuvier and Valenciennes)

Labeo oblongus CUVIER and VALENCIENNES, 1842, vol. 16, p. 357 (Java).
Crossochilus oblongus SMITH, 1931d, p. 187 (Jadi).

This species, known from Java, Borneo, Sumatra, and Malaya, was added to the Thailand fauna in 1928 when a specimen 10.8 cm. long was taken in Tadi Stream, west of the town of Nakon Sritamarat, Peninsular Thailand. This example was typical. The fish must be very rare in local waters.

In the East Indies a length of 16 cm. is attained.

When the genus *Crossocheilus* was established by van Hasselt in 1823, *oblongus* was the only species mentioned. The description was very meager and not sufficient for identification. In 1842 Cuvier and Valenciennes described *Labeo oblongus* as a new species based on van Hasselt's specimen in the Leiden Museum, and declined to recognize the genus *Crossocheilus* as distinct from *Labeo*. Günther (1868, vol. 7, p. 73) and Weber and de Beaufort ascribed the species to Cuvier and Valenciennes but Bleeker credited it to van Hasselt.

CROSSOCHEILUS TCHANGI Fowler

Crossocheilus tchangi Fowler, 1935a, p. 126, figs. 71, 72 (Srisawat).

Known only from a specimen, 17.3 cm. long, from Srisawat, Central Thailand, this fish resembles *C. oblongus* but has a somewhat deeper body, dissimilar mouth structure, and different coloration.

CROSSOCHEILUS RETICULATUS Fowler

Crossocheilus reticulatus Fowler, 1935a, p. 128, figs. 73, 74 (Khao Nam Poo).

Described from two specimens, 7.0 and 6.6 cm. long, from Khao Nam Poo, Central Thailand. The scales of the back and sides are dark-edged, giving the general appearance of a network, and there is a large black blotch at the base of the caudal fin.

CROSSOCHEILUS REBA (Hamilton)

Cyprinus reba Hamilton, 1822, pp. 280, 386 (Bengal, Behar).
Crossocheilus reba Günther, 1868, vol. 7, p. 74 (Siam).—Smith, 1931d, p. 186 (Sikuk River).

This species, occurring throughout India, has been found to be very abundant at times in Central Thailand. A noteworthy run in the Sikuk River, Central Thailand, November 26, 1923, consisted of schools of young fish moving upstream, the schools often reaching from the shores far out into the stream in a solid mass and along the banks for several hundred yards in an unbroken body.

The fishes were from 4 to 8 cm. long, a few of them 9.5 cm.

A similar movement, involving young fishes of this and other species, may be seen in the large rivers of Central Thailand every year. The fishes, hatching in the minor streams that intersect the ricefields during the rainy season, gradually drop down into the main rivers and then, the rains having ceased and the flood waters having begun to subside, they start upstream on a long migration which, in the Menam Chao Phya, may carry them as far as Paknampo or farther into the Meping and Menan, their numbers diminishing daily and only a remnant of the original stock reach the upper waters. They are preyed on by fish, birds, snakes, and monitor lizards, and have to run the gauntlet of innumerable nets and traps set along the shores and operated from boats. It is hardly an exaggeration to state that during this run, which lasts several weeks, every household along the main water courses has in use some kind of fishing appliance. The catch is utilized as food for human beings and domestic animals and, in places where the fishing is concentrated, for the trying out of oil in small vats arranged in rows along the river bank.

Young examples from the Sikuk River sent to the British Museum were courteously examined by J. R. Norman who wrote: "The species is a *Crossochilus*, and is probably identical with *C. reba* (Ham. Buch.), a widely distributed species in India and Burma. We have one young specimen of *C. reba* from Siam (Mouhot collection), which agrees very closely with those sent by you."

It should be pointed out that fresh specimens show no line of demarcation between the snout and the upper lip, as given by Weber and de Beaufort as a generic character.

Crossocheilus reba shares with *Cirrhinus* and other cyprinoids the name *pla soi*, applied to the young fishes that in large numbers undertake the annual upstream movement.

CROSSOCHEILUS CAUDIGUTTATUS Fowler

Crossocheilus caudiguttatus Fowler, 1934a, p. 137, fig. 103 (Chiengmai).

Described from four specimens, 3.8 to 8.2 cm. long, taken at Chiengmai, presumably from the Meping, this species has not been met with elsewhere in Thailand. It is peculiar among the local members of the genus in having a pair of maxillary barbels. The dorsal fin has a sharply defined narrow dark edge and a black blotch on the median part of each membrane.

CROSSOCHEILUS COBITIS (Bleeker)

Lobocheilos cobitis Bleeker, 1853 (86), p. 523 (Padang; Batavia).

This is the only local species of *Crossocheilus* having both rostral and maxillary barbels. It has heretofore been known from Java, Borneo, and Sumatra. A specimen, 5.3 cm. long, typical in all respects, was taken in Bung Borapet, Central Thailand, in March 1933. The species seems to be very rare in that country.

Genus MEKONGINA Fowler

Mekongina Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 200, 1937. (Type, *Mekongina erythrospila* Fowler.)

The outstanding features of the genus *Mekongina* are the absence of a rostral fold and the continuation of the skin of the rostrum as the upper lip; snout with 4 or 5 rows of tubercles arising from craterlike pores; upper lip papillate and fringed, and completely covering the gape when the mouth is closed; upper lip not connected with lower lip but sending a frenulum to lateral part of lower jaw; gill membranes broadly joined to the isthmus; dorsal fin with 10 branched rays.

The pharyngeal teeth present interesting features. In the original description of *Mekongina erythrospila* these teeth are given as in two rows (3,5–5,3), but there is an entirely different formula in one of the two specimens in hand whose teeth have been removed. On each side the teeth are in three rows, with five in the main row, four in the second row, and two in the third row. Outside the main row and parallel and in close approximation therewith there is on each side a row of full-sized teeth, four on the right side, three on the left side, which are not inserted in the pharyngeal bone but are loosely attached by fibrous tissue; and on the left side there is a similar single tooth at one end of each of the second and third rows. It may be inferred that these freely movable teeth with no bony attachment have been displaced by new teeth and would ultimately have become completely shed. A further peculiarity is that between the ultimate and penultimate teeth at one end of the main row on the right side a small tooth (not enumerated in the foregoing count) is visible.

The describer of the genus *Mekongina* compared it only with *Labeo*, from which it "differs in its lip structure and the absence of barbels." *Mekongina*, however, belongs in a different group of the Cyprininae, characterized by the entire absence of a special rostral fold and the continuation of the rostral skin as the upper lip. The relations are closest with *Crossocheilus*, in which, as in *Mekongina*, the lips are not continuous, but in *Crossocheilus* there are barbels in one or two pairs and the dorsal fin has only 8 branched rays, against 10 in *Mekongina*. On the basis of these differences, the genus *Mekongina* may be retained as distinct.

MEKONGINA ERYTHROSPILA Fowler

Mekongina erythrospila Fowler, 1937, p. 200, figs. 161, 162 (Kemarat).

The fish representing this genus and species is known as yet only from the Mekong at Kemarat in Eastern Thailand. Numerous specimens, 7.3 to 19.3 cm. long, collected in 1936, are in the Academy of Natural Sciences of Philadelphia and two in the U. S. National Museum were received by exchange.

Family HOMALOPTERIDAE

Small loachlike fishes found in torrential streams of southern and eastern Asia and the Indo-Australian Archipelago. Their shape and structure, particularly that of the fins, adapt them to the peculiar exactions of their environment. The best and most complete discussion of the classification, habits, and evolution of these fishes has been given by Hora (1932).

The family falls in two subfamilies. In addition to osteological characters, as indicated by Hora (1932), the most obvious difference is in the degree of simplification of the rays of the paired fins. In the Homalopterinae, at least 2, and in some genera 3, 4, or 5, of the anterior ventral rays are simple; and in the various genera from 4 to 13 of the anterior pectoral rays are simple. In the Gastromyzoninae only one ray in the ventral and pectoral fins is simple.

Of the genera recognized as inhabiting Thailand, one is of wide distribution (Northern, Central, Peninsular, and Southeastern Thailand), two are as yet known only from the Thailand-Burmese boundary, and one is herein described as new from Peninsular Thailand. They have the following characterization:

1*a*. Two or more of the anterior rays of the ventral and pectoral fins undivided. Subfamily Homalopterinae.
  2*a*. No deep preoral groove extending around corners of mouth; lips not papillate; a single barbel at each corner of mouth, in addition to 2 pairs of rostral barbels; ventral rays 8 to 10, the 2 outer rays unbranched; pectoral rays 14 to 30, the 4 to 8 outer rays unbranched___ Homaloptera
  2*b*. A deep preoral groove extending around corners of mouth; lips papillate.
    3*a*. Ventral rays 10 or 11, the 2 outer rays unbranched; a single barbel at each corner of mouth, in addition to 2 pairs of rostral barbels.
      4*a*. Body and head greatly depressed; ventral fins not reaching ventral opening, which is nearer to anal fin than to base of ventrals; pectoral fin beginning under eye, the rays 19 to 21, with 8 to 10 outer rays unbranched____ Balitora
      4*b*. Body cylindrical, head greatly depressed; ventral fins extending beyond ventral opening, which is much nearer to base of ventrals than to anal fin; pectoral fin beginning posterior to eye, the rays 14, with 4 outer rays unbranched_____________________________ Balitoropsis
    3*b*. Ventral rays 12 to 18, the 4 or 5 outer rays unbranched; pectoral rays 22 to 26, with 11 to 13 outer rays unbranched; 2 barbels at each corner of mouth in addition to 2 pairs of rostral barbels________ Hemimyzon
1*b*. Only the first ray of the ventral and pectoral fins undivided. Subfamily Gastromyzoninae (no local species yet known).

Subfamily HOMALOPTERINAE

Genus HOMALOPTERA van Hasselt

Homaloptera VAN HASSELT, Alg. Konst. Letterbode, vol. 2, p. 133, 1823. (Type, *Homaloptera fasciata* van Hasselt.)

This is the most numerous genus of homalopterid fishes, and in Thailand is represented by six species, none exceeding 10 cm. in length and most of them much smaller. The genus is otherwise known from the Indo-Australian Archipelago and the southern and southeastern Asiatic mainland, being especially well represented in Java, Sumatra, and Borneo.

Characters on which the species are separated are: The number of scales in longitudinal and transverse series, the degree of squamation of the abdominal surface, the structure of the scales (whether carinated or smooth); the position of the dorsal fin with reference to the ventrals; the number of simple rays in the dorsal, anal, and pectoral fins; and pattern of coloration. Other characters differentiating the species are as follows:

1*a*. Dorsal fin arising in advance of ventrals; scales of back and sides with a strong longitudinal keel; scales in lateral line about 45; pectoral rays iv, 9 or iv, 10; pectoral fins not reaching ventrals; ventral rays ii, 8; back with about 6 obscure dark cross bands; upper caudal lobe with 2 or 3 oblique dark bands; all other fins with dark cross bands______ zollingeri

1*b*. Dorsal fin arising behind origin of ventrals; scales of back and sides not carinated.

  2*a*. Pectoral rays ii, 12 to ii, 14; pectoral fins not reaching to ventrals; ventral rays ii, 8 or ii, 9; back marked with dark saddlelike spots.

    3*a*. Scales in lateral line 42 to 46; back with 6 blackish saddlelike spots. sexmaculata

    3*b*. Scales in lateral line 49 to 51; back with 7 blackish saddlelike spots. septemmaculata

  2*b*. Pectoral rays v, 8 or vi, 8; pectoral fins not reaching to ventrals; ventral rays ii, 6; scales in lateral line 47; back and sides with numerous irregularly disposed black and brown spots of various sizes and shapes, 3 black spots on side of head below eye, all fins barred with black. modesta

  2*c*. Pectoral rays vi, 10 to vi, 12; scales in lateral line 37 to 39.

    4*a*. Pectoral fins longer than head, extending far on ventral fins; pectoral rays vi, 11 or vi, 12; ventral rays, ii, 6; scales in transverse series to base of ventral fin 6–1–4.5; back with about 6 black saddle-shaped bands; all fins with irregular dark bands______________________ smithi

    4*b*. Pectoral fins shorter than head, extending to base of ventral fins; pectoral rays vi, 10; ventral rays ii, 7; scales in transverse series to base of ventral fin 8.5–1–5; a narrow dark stripe from head to base of caudal fin; fins unmarked__________________________________ lineata

HOMALOPTERA ZOLLINGERI Bleeker

Homaloptera zollingeri Bleeker, 1853 (74), p. 159 (Batavia).—Weber and de Beaufort, 1916, vol. 3, p. 14 (Siam).—Hora, 1932, p. 280 (upper Bangpakong River).

Homaloptera maxinae Fowler, 1937, p. 152, figs. 52, 53 (Tachin).

This species, known from Java and Sumatra, has received status as a Thailand fish through representation in the British Museum by a specimen from the upper Bangpakong River. This specimen, presented by the Siamese Museum, is the one referred to by Weber and de Beaufort (1916, vol. 3, p. 14) and Hora (1932, p. 280).

A length of 10 cm. is attained.

The species called *Homaloptera maxinae* by Fowler may represent an immature specimen of the present form. The type and only known specimen of *H. maxinae*, 4.4 cm. long, has as its principal diagnostic features short pectorals (contained 1.25 times in length of head), origin of dorsal fin slightly in advance of that of ventrals, 42 scales in the lateral line, scales of back and sides carinated, about 7 dark brown saddles and several smaller spots on back, 3 dark cross bands on dorsal, 3 or 4 such bands on caudal, and 2 such bands on the anal, ventral, and pectoral fins. Agreement with *H. zollingeri* is very close in most features, and differences may be due to age. The description and figure of the type show only one unbranched ventral ray, which would exclude the species from the genus *Homaloptera* as defined by Hora (1932).

HOMALOPTERA SEXMACULATA Fowler

Homaloptera sexmaculata Fowler, 1934a, p. 98, figs. 47, 48 (Chiengmai).

Known from numerous specimens, 2.1 to 3.4 cm. long, from the Meping at Chiengmai, this species is characterized by having the origin of the dorsal fin behind that of the ventrals, 5 branched rays in the anal fin, pectoral rays, ii, 12, 42 to 46 scales in the lateral line, 6 sharply defined blackish saddles on the back, each caudal lobe with a submarginal black spot, a blackish bar extending from lower base of caudal fin backward toward the spot, and a small blackish spot on the caudal fin near its upper base.

HOMALOPTERA SEPTEMMACULATA Fowler

Homaloptera septemmaculata Fowler, 1934a, p. 99, figs. 49, 50 (Chiengmai).

Seven specimens, 2.5 to 3.7 cm. long, from the Meping at Chiengmai are the basis for this species, which is very similar to *H. sexmaculata*, differing therefrom in having one more major dark spot on the back, 4 of the spots being postdorsal as against 3 in the other species. The general pattern of coloration is practically identical in the two forms, and the only difference except in the maculation appears to be in the lateral-line scales, which number 42 to 46 in *H. sexmaculata* and 49 to 51 in *H. septemmaculata*. It seems probable that these two forms may represent a single species.

HOMALOPTERA MODESTA (Vinciguerra)

Helgia modesta Vinciguerra, 1889–90, p. 202, pl. 11, fig. 12 (Meekalan, Meetan, Burma).
Homaloptera modesta Hora, 1932, p. 288 (Siam, Lower Burma).

The Thailand material representing this species, otherwise known only from Lower Burma, has come from widely separated localities: One specimen from a pond supplied by a stream flowing from the hills at Ronpibun, Peninsular Siam, January 1927, collected by R. Havmöller; one specimen from a waterfall stream at an elevation of 600 meters on Kao Sabap, Southeastern Thailand, April 18, 1930, collected by Luang Masya; and one specimen from the Prau River at Pak Thawan, Southeastern Thailand, April 1, 1931, collected by Layang Gaddi. These specimens were examined by Dr. Hora and found to agree with Dr. Vinciguerra's typical examples of *Helgia modesta* from Burma, collected in the Meetan and the Meekalan, mountain streams flowing westward from the Siam-Burmese frontier into the Houngdarau River.

HOMALOPTERA SMITHI Hora

Figure 54

Homaloptera smithi Hora, 1932, p. 286, pl. 11, fig. 3 (Peninsular Siam).—Fowler, 1934a, p. 98 (Bua Yai, Metang River, Chiengmai, Chantabun); 1939, p. 58 (Trang).

In the upper part of the Tadi River, at Ban Kiriwong, in the Province of Nakon Sritamarat, Peninsular Thailand, this little species was found to be common, and 19 specimens, the largest under 7 cm. long, were collected and preserved on July 10 and 12, 1928. The species has since been found to occur in Northern, Eastern, and Southeastern Thailand as well as in other parts of Peninsular Thailand. A series of 105 specimens 2 to 3.4 cm. long was reported by Fowler from the Meping at Chiengmai and another series of 210 specimens 2.9 to 6.5 cm. long from the waterfall stream in Trang. A single specimen 3 cm. long was collected by Deignan in the Meping at Chiengmai in April 1935. A paratype is U.S.N.M. No. 109821.

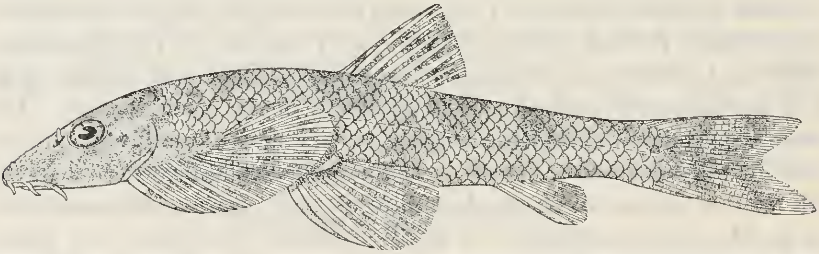


Figure 54—*Homaloptera smithi* Hora: U. S. N. M. No. 109821. Drawn by Miss Jane Roller.

Dr. Hora observed that this species "is distinguished from the other species of the genus by the following combination of characters: the *Balitora*-like general facies, the broad and extensive paired fins, the large eyes, the forward position of the ventrals which do not reach the anal opening, the shovellike lower jaw and the lepidosis. The coloring as well as the nature of the labial grooves are also characteristic of the species."

HOMALOPTERA LINEATA, new species

Figure 55

Description.—Depth about 6.75 in standard length; head 4 in length, its width 1.5 in its length and 1.3 times its depth; eye in middle of head comparatively large, 3.5 in head, 1.3 in snout, and equal to the flat interorbital space; barbels very slender, inner rostral about 0.3 diameter of eye, outer rostral somewhat longer, maxillary about 0.5 eye.

Squamation: Lateral line complete; scales deficient on abdomen; scales in lateral line 37, in transverse series from midline of back to base of ventral fin 8.5–1–5; predorsal scales 21; circumpeduncular scales 14.

Fins: Origin of dorsal fin posterior to origin of ventrals, very slightly nearer to base of caudal fin than to tip of snout; depth of body 4/5 height of dorsal fin, dorsal rays ii, 7; caudal fin about length of head, deeply emarginate, lobes pointed; anal rays i, 6, origin of fin nearer to base of caudal than to base of ventrals; ventrals shorter than pectorals, not reaching anal opening, rays ii, 7; pectorals shorter than head, extending to ventrals, rays vi, 10.

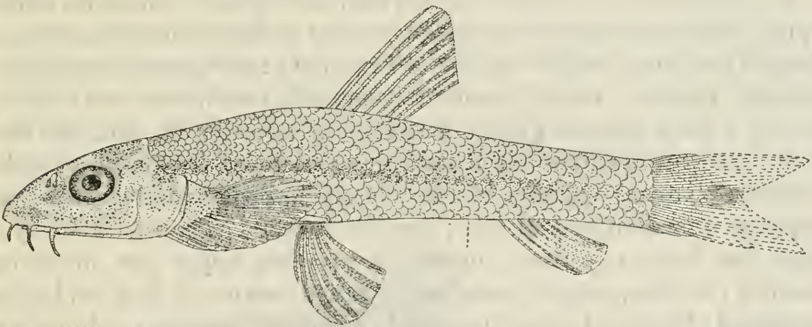


Figure 55.—*Homaloptera lineata*, new species: Type (U.S.N.M. No. 119488). Drawn by Mrs. Alice C. Mullen.

Coloration: A narrow reddish-brown band along lateral line from head to base of caudal fin; body and head otherwise whitish; fins hyaline, unmarked.

Type and paratype.—The type (U.S.N.M. No. 119488), 2.7 cm. long, was collected by H. G. Deignan in the Mekong at Chiengsen Kao, Northern Thailand, January 12, 1937. A paratype 2.4 cm. long (U.S.N.M. No. 119489) was taken at the same place and time.

Remarks.—The relationship of this species to the other members of the genus found in Thailand is sufficiently indicated in the foregoing key. This form is distinguishable from various other species of the East Indian Archipelago, Burma, and India, by its relatively few scales in the lateral line, fin formulae, and distinctive coloration.

The known specimens are apparently immature, a condition which would affect their body proportions and coloration, but not their squamation and fin formulae.

Genus BALITORA Gray

Balitora Gray, Illustrations of Indian zoology, vol. 2, pl. 88, 1833–34. (Type, *Balitora brucei* Gray.)

BALITORA BRUCEI Gray

Balitora brucei Gray, 1833–34, pl. 88, fig. 2 (India).—Hora, 1932, p. 291 (Thaungyin River, Burma-Siam border).

The British Museum has a specimen of this fish, about 10 cm. long, collected by Stockley in the Thaungyin River between Thailand and Burma. As the dorsal surface is black—differing in this respect from the typical form—Hora has proposed for it the varietal name *melanosoma*. The species is known from India and several places in Burma.

BALITOROPSIS, new genus

Body cylindrical, its depth and width at origin of dorsal fin about equal, anteriorly slightly depressed; caudal peduncle moderately compressed; abdomen under surface of head flat; head greatly depressed, obtusely pointed; mouth moderately arched, small, very near tip of snout; a deep, narrow groove between the anterior lip and the rostrum, the groove extending around the corners of the mouth; 4 well-developed rostral barbels, in two closely approximated groups, occupying a median rostral lobe; nostrils rather large, separated by a flap; lips finely papillated, upper lip covering upper jaw, lower lip leaving the sharp-edged lower jaw exposed; scales of back and sides carinated; head and breast unscaled; branchial openings oblique, extending a short distance on ventral surface; ventral opening much nearer to ventral base than to anal fin; dorsal fin arising in advance of ventrals, rays 9, first 2 rays simple; caudal fin long and moderately forked; anal rays 7, first 2 rays simple; paired fins horizontal, broad, and rounded; ventral fins extending far beyond ventral opening but not reaching anal fin, rays 10, of which first 2 rays are simple; pectoral fins arising under middle of branchial openings, rays 14, first 4 rays simple; top and sides of head thickly covered with papillae, which are deficient on ventral surface.

Genotype.—*Balitoropsis bartschi*, new species.

This genus is differentiated from the related genera *Homaloptera*, *Balitora*, and *Hemimyzon* by the characters shown in the preceding key. In the Chinese genus *Sinohomaloptera* there are 2 barbels at each angle of the mouth, the ventral opening is posteriorly placed, the body and head are covered with keeled scales, the ventral fins have 10 rays of which the first 2 are simple, and the pectoral fins have 20 rays, with the first 7 or 8 simple.

BALITOROPSIS BARTSCHI, new species

FIGURE 56

Description.—Head greatly depressed and flattened, obtusely pointed, 4.4 times in standard length, its depth at nape about 0.5 its breadth and somewhat less than 0.5 its length; body cylindrical medianly, moderately compressed posteriorly, and depressed anteriorly, its depth at dorsal origin about equal to head; least depth of caudal peduncle 1.8 times in its length and 2.25 times in head; snout long, bluntly pointed, 0.5 length of head; eyes dorsolateral, entirely in posterior half of head, their diameter five in head, 2.5 in snout, and about two in the flat interorbital space; two pairs of rostral barbels, less than diameter of eye, arranged in pairs on a moderately developed median rostral lobe, the outer barbel extending to the lower lip; the single barbel at corner of mouth somewhat shorter than outer rostral barbel; rostral fold separated from upper lip by a deep groove extending around corners of mouth to posterior lip; mouth rather strongly arched, placed far forward on underside of snout, its diameter about that of eye, lips thin, finely papillated, leaving exposed the front of lower jaw which has a sharp edge and a corneous covering; the short, oblique gill opening extends a short distance on the ventral surface.

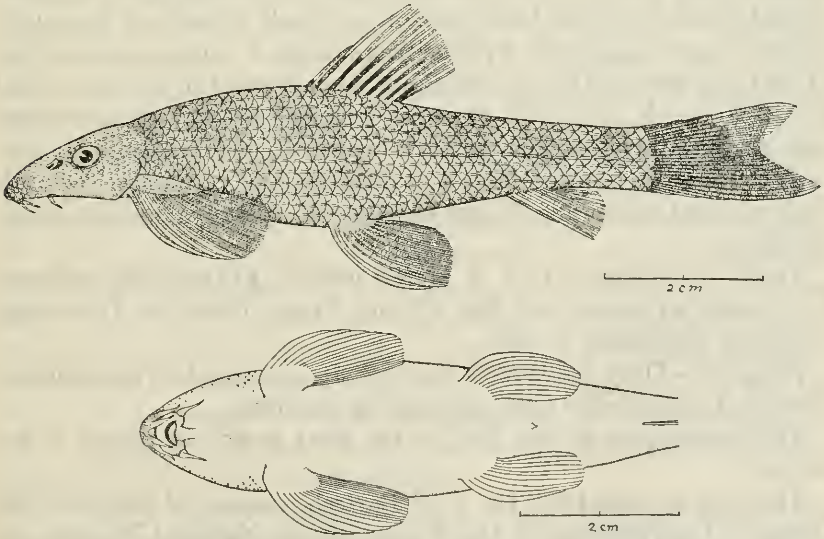


FIGURE 56.—*Balitoropsis bartschi,* new species: Type (U.S.N.M. No. 107963). Drawn by Miss Jane Roller.

Squamation and dermal papillae: Each scale of back and sides with a prominent longitudinal keel, the keels forming conspicuous parallel ridges; keels lacking on under surface of body; no scales on head, on breast, and on median ventral surface anterior to ventral fins; lateral line running in a nearly straight line from upper angle of gill opening to midbase of caudal fin; scales in lateral line 44, in transverse line to base of ventrals 7–1–6, between lateral line and origin of anal 5.5, in predorsal region 13, around narrowest part of caudal peduncle 18. Upper side of head beset with elongate and rounded tubercles, those on top of head mostly elongate and tending to be in longitudinal lines, those on snout largest and rounded.

Fins: Origin of dorsal fin one eye diameter in advance of ventrals and nearer to tip of snout than to base of caudal; dorsal rays ii, 7, first branched ray 1.25 in head; caudal fin longer than head, moderately forked, lobes pointed, lower lobe longer; anal rays ii, 5, longest 1.3 in head; ventral fins shorter than head, not reaching anal but extending far beyond ventral opening, ventral rays ii, 8; pectoral fins about length of head, rays iv, 10, in axil of each pectoral a large, soft, spindle-shaped mass covered with minute papillae and attached to the bases of all the rays.

Coloration: Upper parts dark reddish brown; back and sides with indistinct dark brown areas as follows: a narrow cross band extending from base of pectorals across nape, two large, round predorsal blotches the posterior extending under anterior dorsal rays, a saddle-shaped blotch on back and side below posterior part of dorsal fin, and three obscure cross bands on back between dorsal and caudal fins; abdomen whitish; dorsal fin with basal half of ray black, distal part brownish, contrasting strongly with hyaline membranes, a whitish spot at base of first ray and another at middle of second and third rays; caudal fin mostly black, outer half of upper lobe rich brown; edges of lobes whitish; anal rays blackish or dark brownish, membranes pale; ventrals brown at base, membranes and distal part of rays pale; pectorals with rays and membranes brown basally, pale distally; cephalic tubercles white.

Type.—A specimen (U. S. N. M. No. 107963), 10.3 cm. long, collected in a waterfall stream on Kao Chong, Trang Province, Peninsular Thailand, September 2, 1933.

Remarks.—Only the type is known. It is a female with abdomen distended with minute eggs approaching ripeness.

The name given to this fish by the local mountain people is *pla lin hin.*

This fish is named for Dr. Paul Bartsch, curator of mollusks and Cenozoic invertebrates in the United States National Museum, in appreciation of his extensive and important contributions to Oriental zoology.

Genus HEMIMYZON Regan

Hemimyzon Regan, Ann. Mag. Nat. Hist., ser. 8, vol. 8, p. 32, 1911. (Type, *Homaloptera formosana* Boulenger.)

HEMIMYZON FORMOSANUM (Boulenger)

Homaloptera formosana Boulenger, 1894b, p. 463 (Central Formosa).

This species, described from Formosa, is entitled to a place in the Thailand fauna from a specimen, 9 cm. long, in the British Museum collected by Stockley in the Thaungyin River, which forms a part of the boundary between Thailand and Burma.

Called *Homaloptera* by Boulenger, this fish was made the type of the new genus *Hemimyzon* by Regan in 1911. The outstanding generic characters mentioned by Regan are the posteriorly converging bases of the extended ventral fins and ventral rays numbering 15 or 16, with the first 4 or 5 rays simple. Hora (1932, p. 298) amplified the very brief generic diagnosis given by Regan and included in the genus several Chinese species formerly placed in other genera.

Family GYRINOCHEILIDAE

In some respects the gyrinocheilids are the most remarkable of Oriental fresh-water fishes, taxonomically and physiologically considered. Now placed in a distinct family, they have been variously treated by authors since the first species was described. Vaillant, who established the type genus *Gyrinocheilus* in 1902, placed it in the subfamily Homalopterinae. Boulenger (1904, p. 582) thought *Gyrinocheilus* should be regarded as the type of a distinct subfamily of cyprinidae, coordinate with Catostominae, Cyprininae, Cobitidinae, and Homalopterinae. Later Regan felt that the proper place for the genus was in the Cyprinidae, close to *Crossocheilus* and *Discognathus*, and Weber and de Beaufort (1916, vol. 3) accepted that allocation without comment. Berg (1906), in connection with the description of a new species (*Gyrinocheilus kaznakovi*) from Thailand, definitely established the subfamily Gyrinocheilinae for its accommodation. Jordan (1923) placed the genus without comment in both the Cyprinidae and the Homalopteridae. It remained for Hora (1923b) to give these fishes full family rank, and one need have no hesitation in following him, for they exhibit a combination of peculiar features: Mouth structure, absence of pharyngeal teeth, presence of both exhalent and inhalent gill openings, and other characters, which taxonomically are quite as significant as those that are used to separate the Cobitidae and Homalopteridae from the Cyprinidae.

The family is herein recognized as having a single genus. *Gyrinocheilops*, as established by Fowler (1937), is not acceptable as a genus distinct from *Gyrinocheilus* from the information now available. Fowler distinguished the genera as follows:

Predorsal scales small; scales on caudal base small; eye well postmedian or near last third in head; 2 rows of large, dark, alternating or opposed spots along side of body-- Gyrinocheilus

Predorsal scales very small and crowded; scales on caudal base large; eye slightly postmedian in head; 2 rows of large dark spots only partly or not at all alternating along side of body------------------------------------ Gyrinocheilops

The opinion is held that the differences here indicated, insofar as they are constant, have only specific, not generic, significance, and that *Gyrinocheilops* (type *pennocki* from the Mekong) is a synonym of *Gyrinocheilus* (type *pustulosus* from Borneo).

Genus GYRINOCHEILUS Vaillant

Gyrinocheilus Vaillant, Notes Leyden Mus., vol. 24, p. 107, 1902. (Type, *Gyrinocheilus pustulosus* Vaillant.)

This outstanding genus may at once be recognized by the absence of a rostral fold, the ventral surface of the snout being continued as the upper lip; by the close union of the upper and lower lips on each side into a coil occupying the postlabial groove; by the rasplike folds of the inner surface of the lips; by the fleshy prolongation of the isthmus into the postlabial groove immediately behind the lower lip; by the absence of pharyngeal teeth; and by the existence, above the regular branchial opening, of a supplementary opening which has an inhalent function.

The first fish referable to this genus seems to have been described by Tirant in 1883, but as it was placed in the genus *Psilorhynchus* and the description and figures were faulty, the status of the species remained uncertain until Hora (1935) recognized its true relations. In the meantime, Vaillant (1902) described *Gyrinocheilus pustulosus* as a new genus and new species from Borneo; and Berg (1906) described *G. kaznakovi* from a part of Southeastern Thailand now in Cambodia, this form being apparently referable to Tirant's *Psilorhynchus aymonieri*. More recently another species, *G. pennocki*, has been described by Fowler (1937) from the Mekong, where it forms the boundary between Eastern Thailand and Cambodia.

Two so-called new species of *Gyrinocheilus* (*G. roulei* and *G. pellegrini*) described from Szechwan, western China, by Tchang cannot possibly represent this genus, and their possession of a single branchial aperture excludes them from this family.

1*a*. Branched dorsal rays 9; eye in adult well behind midlength of head. aymonieri

1*b*. Branched dorsal rays 10; eye in adult nearly in midlength of head-- pennocki

GYRINOCHEILUS AYMONIERI (Tirant)

Psilorhynchus aymonieri Tirant, 1883, p. 35 (new pagination) (Samrong-Tong Mountains, near Phnom-Penh, Cambodia).

Gyrinocheilus aymonieri Hora, 1935, p. 459, figs. (Cambodia, Siam).

Gyrinocheilus kaznakovi Berg, 1906, pp. 306, 365 (Pailin).—Smith, 1931d, p. 187 (Siam generally).—Fowler, 1934a, p. 137 (Chiengmai, Metang River).

Gyrinocheilus kaznakoi Hora, 1923b, p. 159, fig., pl. 12, figs. 4–7 (Nontaburi, Pailin).

Gyrinocheilops kaznakoi Fowler, 1937, p. 160, fig. 96 (Paknam, Tachin); 1939, p. 74 (Trang).

This species has been found to have a very wide distribution in Thailand. Specimens have been examined from the Menam Chao Phya at Nontaburi and Paknam, Central Thailand; from Bung Borapet and various outlets of that swamp, Central Thailand; from streams entering the Menam Sak from the east, Central Thailand; from headwaters of the Menam Mun near Pakjong and from the Menam Pong, tributary of the Menam Mun, Eastern Thailand; from the Meklong at Potaram and from the west branch of the Meklong above Kanburi, Central district; from upper waters of the Menam Nan, Northern region; from the Meping at Chomtong and from the Mewang, Mekhan, and Mechem, tributaries of the Meping, Northern area; and from the Menam Tapi and other streams in the Peninsula. The extension of the range farther south in the peninsula has been recorded by Fowler (1939) from a waterfall stream near Trang.

The fish is as yet unknown, and may be absent, from the Southeastern region (as now limited) and from the basins of the Salwin and other streams tributary to the Bay of Bengal in Northern and Western Thailand.

The remarkable modification in the branchial apertures in this species is no doubt typical of the family. The usual exhalent opening, closed by a broad membranous flap, is confined mostly to the side above the pectoral base; a portion extends for a short distance on the broad ventral surface immediately in front of the pectoral. Above the exhalent slit is a deep, narrow, vertical inhalent opening which communicates with the mouth cavity in front of the gills. This opening, whose vertical dimension exceeds the diameter of the eye, is closed by a delicate velum attached along the anterior wall, while the free upper end of the opercular flap extends along the posterior wall of the lower third of the slit.

The quantity of water that may enter the inhalent openings is small; and in order that sufficient oxygen-bearing water may reach the gills the respiratory movements are extremely rapid. Observations made on fishes up to 12 cm. long that had been in a large aquarium for 2 years and were still perfectly sound showed a respiratory rate of 230 to 240 per minute, as evidenced by the pulsations of the opercular flaps. A favorite resting attitude for the fish was with the head projecting over a stone with the body supported by the pectoral fins. At intervals all respiratory movements were suspended for a period of 6 to 10 seconds.

Protracted observation of the fish in aquaria in Thailand failed to indicate normal breathing as in other fishes, the taking of water through the mouth and passing it out over the gills. The ability to breathe like ordinary fishes seems to have been entirely lost.

Although the fish possesses a swim bladder, this organ, as in various other mountain-stream fishes of the Orient, is very small and is inadequate to function hydrostatically. The fish is unable to maintain itself off the bottom except by active swimming efforts.

Radial flanges are highly developed on the dorsal and anal fins of all adult examples. Their purpose is suggested in an introductory chapter (page 32).

The young are strikingly marked. In examples 4.6 to 5.5 cm. long taken in Bung Borapet in August there is a brown band extending along the lateral line from the base of the caudal fin to the head, through the eye, to the tip of the snout, and from this band there extend upward and downward about 11 short brown bars or spots into the brownish yellow of the back and the creamy yellow of the side. In specimens 6.9 to 7.7 cm. long collected in Bung Borapet in November, the two series of brown spots along the side have become more distinct, and about 11 dark brown blotches appear on the back. The caudal fin shows irregular cross lines of brown spots. In fishes from about 8 to 8.5 cm. long the longitudinal brown band disappears, and each scale may have a well-defined brown spot at its base. With further growth of the fishes into adult size, the brown spots on side and back may be obscured or completely obliterated, as the general coloration of the fish becomes dark brown or almost black in some examples.

Rostral tubercles begin to appear in fishes about 10 cm. long, and by the time full sexual maturity is reached the tubercles form a conspicuous outgrowth on the snout. They are present in both sexes but are much more developed in the male and take the form of stout conical horny spines occupying pores, arranged in definite groups: A transverse band on the front of the snout; a broad median band separated from the transverse band by a deep groove, and extending to and behind the nostrils; and two or three small lateral groups in advance of the nostrils separated on each side from the median band by a groove, which is continuous with the cross groove.

The fish regularly attains a length in excess of 20 cm., and maturity is reached at 12 to 15 cm. The largest specimen obtained, 27.5 cm. long, was taken in the Mekhan, Northern Thailand, February 8, 1932.

While the fish is primarily and essentially an inhabitant of mountainous regions, it nevertheless is sometimes found in the sluggish waters of the plains and may occur there in great abundance, as in Bung Borapet. A noteworthy extension of range into the coastal plain streams is seen in the records for the Menam Tachin (Fowler, 1937) and the Menam Chao Phya at Nontaburi and near its mouth at Paknam.

It is a strict vegetarian. Its long coiled intestine is usually found crowded with amorphous green material representing algae that is cropped from stones. This feeding habit is accounted for by the absence of pharyngeal teeth, which are unnecessary because the small oral opening does not permit the taking of food that requires mastication. The scraping of the algae from stones is facilitated by the rasplike folds of the inner surface of both lips.

The same peculiar mouth structure enables the fish to adhere to hard surfaces, and thus to maintain itself in swift water. The use of the mouth as a sucking organ is, however, not confined to flowing water but is regularly seen in fish in balanced aquaria. Numerous observations on such fish indicate that when resting they prefer to attach themselves to the bottom or to the vertical sides up to several feet above the bottom, even in the complete absence of any current.

The tip of the snout, with its strong spines, is rather freely movable, and in handling live specimens a person may have his fingers severely pinched between the movable group and the fixed median band.

A fish imperfectly described and inaccurately figured by Tirant in 1883 under the name *Psilorhynchus aymonieri* remained a puzzle until Hora (1935), having obtained photographs of the type in the Museum of Natural Sciences of Lyons, was able to decide that the fish is not a *Psilorhynchus* but a *Gyrinocheilus*, identical with *G. kaznakovi* Berg (1906). The type of *G. aymonieri* came from the basin of the Mekong near Phnom-Penh, Cambodia; the type of *G. kaznakovi* came from a stream flowing into the Tonle Sap, Mekong basin, at Pailin, then in Thailand, now in Cambodia.

The fish bears several vernacular names in different parts of its range. In the Paknampo region, including the upper Menam Chao Phya, the lower Menam Nan, and Bung Borapet, it is called *pla rak kluey*. A name in use at Lampang and on the Mekhan in Northern Siam is *pla mood*. Fishermen on the Mekhan employed also the name *pla yalu*. On the Meklong in the Potaram section and in the west branch of the Meklong above Kanburi, the designations are *pla piing* (bee fish) and *pla luk piing* (young bee fish), perhaps in allusion to the dense swarms of fish about 5 cm. long found along the shores in August to November. At Udon on the Menam Pong in Eastern Thailand the fish is recognized under the name *pla plak lai* (lower-mouth fish).

GYRINOCHEILUS PENNOCKI (Fowler)

Gyrinocheilops pennocki Fowler, 1937, p. 161, figs. 98, 99 (Mekong at Kemarat).

Described from a specimen 14.5 cm. long, with a paratype 7.8 cm. long, this fish is known only from the Mekong at Kemarat in Eastern Thailand. The species is very similar to *G. kaznakovi* Berg, from which it may differ in having the eye placed near the midlength of the head and in the presence of 10 branched rays in the dorsal fin. The position of the eye, however, in *aymonieri* varies with age, being more advanced in the young; and in a few examples the branched dorsal rays have been found to number 10. The proportions, squamation, and general pattern of body coloration are the same in the two forms. A reported color difference is the absence in the present species of a dark spot immediately posterior to the inhalent gill-opening, which is characteristic of *aymonieri*.

Family COBITIDAE: Loaches

This strictly Old World family is well represented in Thailand. Most of the species are of small size and they frequent mountain streams; a few are found in larger rivers, and some occur even in lakes. Of the eight genera so far detected in Thailand, six have a wide distribution in India, Burma, Malaya, Indo-China, China, and the East Indian Archipelago, and two are peculiar to Northern Thailand.

The loaches are of little commercial importance. Some of the larger forms (such as certain species of *Botia*) are seen in the markets of the more populous communities. Nearly all the species are eaten by the country people, especially in the mountainous districts.

Fishes of most of the species are protected from danger by burying themselves, sometimes with great rapidity, in the sand or gravel of stream bottoms, and most of them enjoy some immunity from capture by snakes, water lizards, birds, and other fishes owing to a pair of erectile suborbital or preorbital bony spines, which may be locked firmly in position.

The following characters will differentiate the species:

- 1*a*. An erectile spine arising from ethmoid bone and concealed in a groove under or before each eye.
  - 2*a*. Form oblong; eyes not covered with skin; a bifid spine below and partly before eye; origin of dorsal fin over or in advance of base of ventral fins; 3 pairs of barbels (2 rostral, 1 maxillary) ________________ **Botia**
  - 2*b*. Form elongate; eyes covered with skin.
    - 3*a*. Origin of dorsal fin before, over, or very slightly behind base of ventral fins; head with or without scales; 3 or 4 pairs of barbels.
      - 4*a*. Head partly scaled; barbels 4 rostral, 2 maxillary, 2 mandibular; caudal fin truncate or slightly emarginate ________ **Lepidocephalus**

4*b*. Head wholly scaleless; barbels 2 rostral, 4 maxillary.
  5*a*. Lateral line complete; a concealed bifid spine far in advance of eye; eye in posterior third or posterior half of head; origin of dorsal fin in advance of origin of ventrals; caudal fin forked or deeply emarginate---------------------------------- Acanthopsis
  5*b*. Lateral line incomplete; a concealed bifid spine partly under and partly before eye; eye mostly in anterior half of head; origin of dorsal fin over origin of ventrals; caudal fin truncate. Neacanthopsis
3*b*. Origin of dorsal fin well behind base of ventrals; head scaleless.
  6*a*. Three pairs of barbels, 1 rostral, 1 maxillary, and 1 mandibular.
    7*a*. Body very elongate but not anguilliform; dorsal fin entirely in advance of anal---------------------------- Acanthophthalmus
    7*b*. Body anguilliform; dorsal fin partly over anal-------- Cobitophis
  6*b*. Four pairs of barbels, 1 rostral, 2 maxillary, 1 mandibular. Acanthopsoides
1*b*. No spine under or before eye--------------------------------- Noemacheilus

Genus BOTIA Gray

Botia Gray, Zoological Miscellany, 1831, p. 8. (Type, *Botia almorhae* Gray.)

Among the loaches of this genus in Thailand are the largest and some of the commonest members of the family. The species are more numerous than in any other local genus except *Noemacheilus.*

The large bifid suborbital spines, which can be erected and set in a position perpendicular to the cheek, must be of material value in discouraging attacks by snakes and fishes. Both snakes and fishes have been seen in which the spines of partly swallowed *Botia* had perforated the sides of the neck or throat, with disastrous results.

The local species, six in number, may be distinguished easily by their coloration, which in all is striking and in some is brilliant, and by the following characters:

1*a*. Body marked by dark cross bands.
  2*a*. Cross bands 10 to 15, equal to or wider than interspaces; no dark median dorsal stripe.
    3*a*. Distal margin of dorsal fin either wholly or partly black; branched dorsal rays 9 or 10-- lucas-bahi
    3*b*. Distal margin of dorsal fin pale; branched dorsal rays 11 to 13 -- hymenophysa
  2*b*. Cross bands 5, much narrower than interspaces; a black median dorsal stripe from tip of snout to base of caudal fin; branched dorsal rays 8; origin of dorsal fin in advance of ventrals and nearer to base of caudal fin than to tip of snout; caudal peduncle deeper than long---------- horae
1*b*. Body without dark cross bands, at least in adults; branched dorsal rays 8 or 9; caudal peduncle deeper than long.
  4*a*. Coloration plain.
    5*a*. A large roundish dark gray spot on caudal peduncle; origin of dorsal fin over base of ventrals and midway between tip of snout and base of caudal fin; head 3.5 in standard length------------------- lecontei

5*b*. No dark spot on caudal peduncle; origin of dorsal fin in advance of base of ventrals and nearer to base of caudal fin than to tip of snout; head 2.9 to 3.5 in standard length ---------------------------------- modesta

4*b*. Body marked with 4 longitudinal rows of ocellated spots and a series of dark brown parallel longitudinal lines on back anterior to dorsal fin; origin of dorsal fin in advance of base of ventrals and midway between tip of snout and base of caudal fin; head 3.75 in standard length--- beauforti

BOTIA LUCAS-BAHI Fowler

Botia lucas-bahi FOWLER, 1937, p. 154, fig. 70 (Tachin); 1939, p. 59, figs. 7–9 (Trang).

This species was based on a specimen 7.3 cm. long, from the Tachin River, marked by about 10 irregular dark cross bands on body, several irregular rows of small dark spots on side, and a very narrow black edge to the dorsal fin, with 9 branched rays in the dorsal. A second specimen 9 cm. long, from the Meping at Chiengmai, having about 12 irregular dark cross bands, no small spots in the side, and a narrow black edge to the dorsal, with 7 branched dorsal rays, is considered by Fowler a paratype of *B. lucas-bahi*, but it was originally described and figured as *B. hymenophysa* (Fowler, 1934a, p. 101, fig. 52).

In the Deignan collection there is one lot of five specimens, 2.5 to 6 cm. long, from the Meping at Chiengmai which may be referred to this species, although only two of them are in agreement with the type in the color distinction of a black edge to the dorsal fin on which stress is laid. These two are the largest, 5 and 6 cm. long, and have 11 or 12 blackish cross bands and a narrow black edge on the dorsal fin. The two smallest, 2.8 and 2.9 cm. long, show six very distinct narrow black cross bands, the broadest at the base of the caudal fin, and no black edge on the dorsal fin. In the fifth specimen, 3.3 cm. long, with six cross bands, there is evidence on the back of new cross bands appearing between the others, and there is no black edge to the dorsal fin.

Additional material, from a waterfall stream near Trang, is described and figured by Fowler (1939) and compared with *B. hymenophysa* and *B. berdmorei*. Except on the theory of an exceedingly variable species, it is difficult to identify the specimen from Trang figured by Fowler with the figure of either type or the paratype, the differences being in body proportions, in relative length and depth of the caudal peduncle, in origin of the dorsal fin with reference to the ventrals, in coloration, and other minor characteristics. Excluding the "paratype," whose 7 branched dorsal rays would seem to remove it entirely from consideration, the possibility that *B. lucas-bahi*, like *B. berdmorei* (Blyth), may represent a normal variation in *B. hymenophysa* is strongly indicated.

BOTIA HYMENOPHYSA (Bleeker)

Cobitis hymenophysa Bleeker, 1852 (67), p. 602 (Palembang, Sumatra).
Botia hymenophysa Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 175 (Siam).—Günther, 1868, vol. 7, p. 368 (Siam).—Sauvage, 1881, p. 164 (Siam); 1883b, p. 154 (Menam Chao Phya).—Weber and de Beaufort, 1916, vol. 3, p. 24 (Siam).—Hora, 1923b, p. 148 (Nontaburi).—Fowler, 1934a, p. 101, figs. 51, 52 (Chiengmai); 1935a, p. 106 (Srisawat, Khao Nam Poo); 1937, p. 154, figs. 64–69 (Bangkok, Tachin, Kemarat).
Botia hymeophysa Smith, 1930, p. 55 (Siam).

This is a very common fish in parts of Central and Northern Thailand, in the basin of the Menam Chao Phya. During November of several years Klong Borapet, the principal outlet of Bung Borapet, was found to be literally teeming with fish 6 to 8 cm. long on their way from the lake to the Menam Nan. In the basin of the Mekong, the fish has been taken at Kemarat in the Mekong, and in the Menam Chi at Udon, Eastern Thailand.

The maximum size of the fish in Thailand is about 22 cm., but the usual run of adult fish is 12 to 15 cm.

This is a strikingly beautiful fish in life, undergoing considerable change in pattern of coloration with age. Two adults, 12.8 and 13.1 cm. long, obtained in the Menam Chao Phya near Bangkok November 30, 1930, had the following coloration when taken from the water: Back and sides yellow, with 11 slightly oblique blue cross bands wider than the interspaces, the dorsal part of the last cross band much darker and constituting a blue-black spot, top of head blue; belly and underside of head pale yellow; dorsal fin yellowish orange, with 4 blue cross lines; caudal fin yellowish green, with 4 narrow blue cross lines on basal half; anal, ventral, and pectoral fins bright yellow.

Two specimens in the British Museum from "Pachebon" on the upper Pasak were collected by the celebrated traveler and explorer Mouhot. Regarding these specimens Günther said (1868, vol. 7, p. 368), "A variety * * * having only eleven cross bands, which do not appear to be edged with blue, and the last cross band terminates in a black spot superiorly on the root of the caudal fin." This is a common color phase of the species, and such specimens have been met with at Bung Borapet, Bangkok, and other places.

Fowler (1934a) published two figures of *B. hymenophysa* from Chiengmai to show variations in color, but the specimens on which the drawings were based are obviously not conspecific, one (fig. 51) having 12 branched rays in the dorsal fin, the other (fig. 52) having 7 such rays. Fowler later (1937) identified the latter figure with his *B. lucas-bahi*, from the Tachin.

Throughout its range the fish is known as *pla mu* (hog fish), a name borne also by other species of this genus. A distinguishing name used in some sections is *pla mu kang lai* (striped-side hog fish).

BOTIA HORAE H. M. Smith

FIGURE 57

Botia horae SMITH, 1931a, p. 4, fig. 2 (Meklong).—FOWLER, 1937, p. 154 (Meping at Chiengmai).
Botia modesta FOWLER, 1934a, p. 101, figs. 53, 54 (Chiengmai).

This fish, described from two small specimens from the west branch (Kwe Noi) of the Meklong, has since been found to have a rather wide distribution. Specimens have been examined from such widely separated localities as the Meping at Chiengmai, Northern Thailand, the headwaters of the Menam Mun at Pakjong, Eastern Thailand, and the headwaters of the Tapi in the Peninsula.

This is a small species. The maximum size of specimens examined was 9.5 cm., a female with greatly enlarged ovaries taken at Pakjong June 20, 1934.

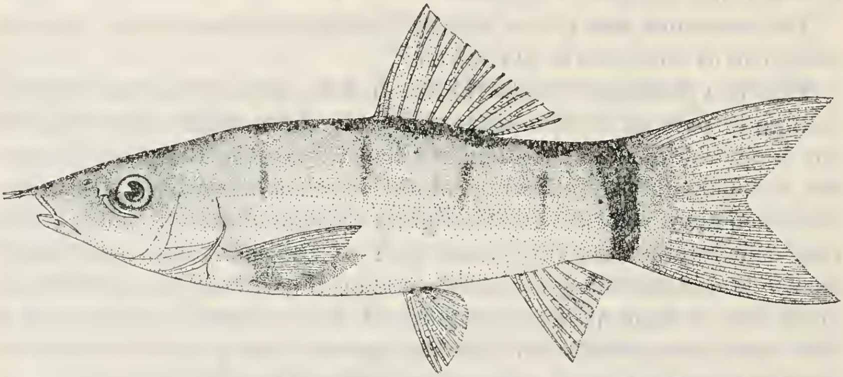


FIGURE 57.—*Botia horae* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

The species has a characteristic coloration at all ages: The general color of head and body is light brown; there is a broad black median stripe extending along the dorsal surface from the tip of the snout to the base of the caudal fin, this stripe connected posteriorly with a broad transverse band across each side of the caudal peduncle at the base of the caudal fin. The body and sides are marked by narrow dark vertical cross bands, which are most conspicuous on, and may be restricted to, the anterior third of the body but may extend the entire length. The caudal fin has numerous small round brownish spots, which tend to form into transverse lines. In examples up to 4 cm. long the black middorsal stripe may be composed of rounded or elongated divisions, which may be disconnected, and there are three or four evenly spaced black cross bands. Color variations in adult examples are (1) the division of the middorsal stripe into two narrower sections, which enclose the base of the dorsal fin, while ordinarily the black stripe does not divide but extends in an unbroken band to the base of the dorsal rays, and (2) the inclusion in the caudal peduncular cross band of a circular spot of the general color of the body.

Fowler (1934a) published two figures of *B. modesta* showing a black median dorsal stripe extending from tip of snout to base of caudal and a black transverse band on caudal peduncle. In a later paper (1937), however, he refers these figures and the specimens on which they are based to *B. horae*.

BOTIA LECONTEI Fowler

Botia lecontei FOWLER, 1937, p. 156, figs. 71–74 (Kemarat).

Known from a single specimen, 10 cm. long, from the Mekong at Kemarat, Eastern Thailand. The features that are said to distinguish this fish from *B. modesta* are a more slender body (depth 3.5 in length as against 2.7 to 3.5 in modesta) and a dark blotch at the caudal base (lacking in *modesta*). Another apparent difference is the position of the dorsal fin, as indicated in the key.

BOTIA MODESTA Bleeker

Botia modesta BLEEKER, 1865 (343), p. 11 (Siam); 1865 (347), p. 35 (Siam); 1865 (356), p. 175 (Siam).—GÜNTHER, 1878, vol. 7, p. 368 (Siam).—SAUVAGE, 1881, p. 164 (Menam, Pachebon); 1883b, p. 154 (Menam Chao Phya).—HORA, 1922, p. 317 (Siam); 1923b, p. 148 (Nontaburi).—FOWLER, 1934a, p. 101, figs. 53, 54 (these figures representing *B. horae*, fide Fowler, 1937, p. 154) (Chiengmai); 1935a, p. 106, fig. 33 (Bangkok); 1937, p. 156 (Pitsanulok, Kemarat).

The range of *B. modesta* in Thailand extends from the upper Meping at Chiengmai to the lower Menam Chao Phya at or below Bangkok, and from the Mekong to the Meklong. The fish abounds in the lower Menam Sak below the barrage at Dha Luang. It is exceedingly abundant in Bung Borapet and other waters in the Paknampo region. Specimens are at hand from the Meklong and from its eastern branch near the town of Kanburi. In Eastern Thailand the fish has been collected in the Menam Chi and the Menam Pong in the province of Udon, and there is also a record for the Mekong at Kemarat. Specimens in the British Museum are from Pechabun on the upper Pasak River (Mouhot collection) and from the upper Bangpakong River (from Siamese Museum).

The general body color ranges from rich gray-blue to gray-green, bluish green, yellow, and salmon, with the belly pale yellow or white. All the fins may be bright orange, orange-red, or yellow, with the ventrals usually paler than the others. The iris is yellow, orange, or red. In the young there are four or five broad black cross bands on back and side, with about the same number of narrower intervening bands;

and in addition a broader black band on the caudal peduncle at the base of the caudal fin. In the Menam Chao Phya in the Bangkok district, at about a length of 8 to 8.5 cm., the cross bands disappear, although the band on the caudal peduncle may persist a little longer.

A specimen, 8.3 cm. long, from the Menam Chao Phya at Nontaburi is a female with well-developed ovaries. A length exceeding 15 cm. is often attained. The largest specimens examined, collected by H. G. Deignan in the Meping at Chiengmai, in April 1935, were 21.1 and 23.5 cm. long, the smaller a male, the larger a female with ripe eggs.

The fish is often seen in the markets, and is known to fishermen, market men, and the general public as *pla mu* (hog fish), which is sometimes amplified to *pla mu khao* (white hog fish) to distinguish it from *B. hymenophysa.* The name *pla mu* is in allusion to the large erectile suborbital spine suggestive of the tusk of a hog.

BOTIA BEAUFORTI H. M. Smith

FIGURE 58

Botia beauforti SMITH, 1931a, p. 2, fig. 1 (Nakon Sritamarat).

The type specimen of this species came from the Tadi River at Ban Kiriwong, Province of Nakon Sritamarat, Peninsular Thailand. It is 17.5 cm. long.

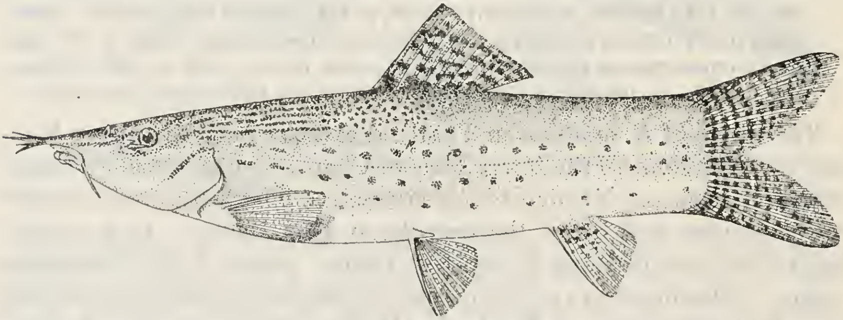


FIGURE 58.—*Botia beauforti* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

The species is strikingly marked: The body and head are light gray-green; on the body there are four irregular rows of dark brown spots each surrounded by a pale ring; on each side of the back from the head to two-thirds the distance to the dorsal fin there are five parallel longitudinal dark brown lines, followed by an area of small dark brown spots extending to the posterior end of the dorsal base; on the head are several dark brown curved stripes; the dorsal and caudal fins are bright orange with transverse rows of black spots; the anal fin is yellow with brown spots on basal half; the ventral and pectoral fins are pale orange.

A specimen, 19.2 cm. long, from the headwaters of the Menam Mun at Pakjong, June 21, 1934, has the body marked with numerous dark spots tending to form longitudinal lines, the dorsal and anal fins marked as in the type but the caudal is plain; the dorsal fin, with nine branched rays, arises appreciably in advance of the ventrals. The fish is a female with nearly ripe eggs, the ovaries being 6 cm. long.

The nearest relative is *B. berdmorei* as described and figured by Day, which shows a number of differences in form and color: there are 11 to 13 branched dorsal rays (instead of 9 as in *B. beauforti*), the origin of the ventral is slightly in advance of that of dorsal (instead of considerably behind), there are 10 or 11 dark cross bands from back to abdomen (instead of none), and there are no parallel dark stripes on the back anteriorly.

Fowler (1934a) thought *B. beauforti* synonymous with *B. hymenophysa* but later (1937) revised that opinion.

The local people call it *pla mu* and say it gets to be about 25 cm. long.

Genus LEPIDOCEPHALUS Bleeker

Lepidocephalus Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 16, p. 303, 1858–59. (Type, *Cobitis macrochir* Bleeker.)

The lepidocephalids are small fishes found mostly in swift brooks but also in swamps and lakes. They appear to prefer sandy or fine gravelly bottom, into which they are able to burrow and quickly disappear, if alarmed or frightened. According to Day, the spinous first pectoral ray helps in "digging in."

The local species may be distinguished as follows:

- 1*a*. Scales in lateral line about 100 or more.
  - 2*a*. Caudal fin truncate.
    - 3*a*. Depth of caudal peduncle equal to or less than its length; back and side with small dark brown patches of irregular shape, sometimes forming a row along side; a round black spot at upper part of caudal base; all fins sometimes with transverse rows of dark spots on rays, the spots sometimes confined to dorsal and caudal---------- octocirrhus
    - 3*b*. Depth of caudal peduncle greater than its length; side with a row of 12 to 15 dark spots; a broad median dark band from occiput to dorsal fin; a black spot at upper part of caudal base; dorsal and caudal fins with 6 or 7 transverse rows of dark spots on rays-------- cataractus
  - 2*b*. Caudal fin emarginate; side with a well-defined dark longitudinal stripe connecting dark spots------------------------------------ berdmorei
- 1*b*. Scales in lateral line about 72; body with 10 to 12 rather obscure brown saddles; a small black spot at base of first dorsal rays; a dark brown stripe along side from head to caudal base; dorsal fin with transverse rows of dark spots on rays; caudal fin with 6 or 7 transverse rows of dark streaks -- taeniatus

LEPIDOCEPHALUS OCTOCIRRHUS (van Hasselt)

Figure 59

Cobitis octocirrhus van Hasselt, 1823, p. 133 (Java).
Lepidocephalus hasselti Hora, 1924a, p. 468 (Tale Sap).
Lepidocephalus hasseltii Fowler, 1934a, p. 104 (Chiengdao, Chiengmai, Chantabun).

This fish is known from Java and Sumatra and from parts of Burma adjacent to Thailand (although not recorded by Day). It was first recorded from Thailand in 1924 when Hora reported a young specimen from the Tale Sap. Since that time it has been taken in various parts of the country: Numerous localities in Peninsular Siam, including a mountain brook near Patalung, Klong Thalerng near Ronpibun, Klong Tadi and Klong Nakon Nai in Nakon Sritamarat; Bung Borapet, Central district; the Meping at Chiengmai and Chiengdao, Northern area; Chantabun and Nong Yang, Southeastern region; and a small stream entering the Mekong at Chaiburi, Eastern Thailand. More recently Deignan has taken numerous specimens in Huey Aw, a tributary of the Menam Nan in the Northern region, and in the Menam Mao, a tributary of the Menam Fang (thence via the Menam Kok into the Mekong) and has extended the range to Burma by obtaining specimens in the Salwin at Ta Ta Fang, in Northern Thailand, where that river forms the boundary between Thailand and Burma.

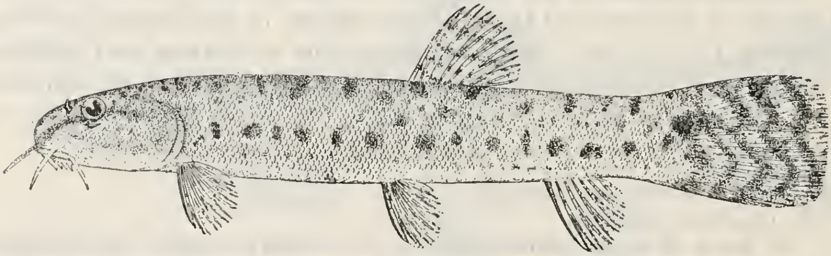


Figure 59.—*Lepidocephalus octocirrhus* (van Hasselt). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Although a length of only 5 cm. is ascribed to the fish by Weber and Beaufort, specimens up to 8.9 cm. have been collected in Peninsular Siam and a length of 12 to 14 cm. is reported by local fishermen.

The favorite haunts are clear, swift streams with sandy bottom.

Among specimens collected in the Meping at Chiengdao April 28, 1925, is a female, 6.5 cm. long, containing well-matured eggs. Numerous young specimens with the same data indicate that up to a length of about 4 cm. there is a well-defined dark line along the side, with no indication of the dark spots which are seen in older fish; at the size indicated dark spots begin to appear along the side and the line gradually disappears. Specimens 7.1 to 7.7 cm. long from the

Salwin, October 14 and 15, 1936, show 5 regular black cross lines on the caudal fin.

A lot of 13 specimens, 4.7 to 7.1 cm. long, taken in the Menam Mao December 26, 1936, at a point where the river was a torrent, is noteworthy for the intensity of the dark brown markings on head, body, and fins. The caudal fin has 4 or 5 regular V-shaped bands, and the anal, ventral, and pectoral fins, which do not appear to have been previously described as having any markings, are banded with rows of spots on the rays.

This species has usually been called *Lepidocephalus hasselti* (Cuvier and Valenciennes, 1846). Those authors, however, based their description on a drawing sent from Java by Kuhl and van Hasselt and made no mention of the fact that van Hasselt had already given the name *L. octocirrhus* to the same fish in 1823. Weber and de Beaufort (1916, vol. 3) rejected van Hasselt's name because of "insufficient description," but the fact that the fish was recognizable from the description would seem to validate the name. Bleeker (Atlas Ichthyologique, 1863 (301), vol. 3, p. 13) placed *L. octocirrhus* in the synonymy of *L. hasselti* without comment.

A variety of names is borne by the fish in different parts of its Thai range: *pla sai* (sand fish) in Nakon Sritamarat, *pla mu* (hog fish, in allusion to the tusklike spines), in Bung Borapet, *pla chon* (literally, sideways-moving fish) in the Meping at Chiengdao, and *pla kluey* in Chantabun.

LEPIDOCEPHALUS CATARACTUS Fowler

Lepidocephalus cataractus Fowler, 1939, p. 60, fig. 10 (Trang).

Numerous specimens of this fish were available to Fowler in describing the species, all from the waterfall stream near Trang, in Peninsular Thailand. The principal characters are shown in the key.

Maximum length, 8.4 cm.

LEPIDOCEPHALUS BERDMOREI (Blyth)

Syncrossus berdmorei Blyth, 1860b, p. 166 (Tenasserim).
Lepidocephalus berdmorei Suvatti, 1936, p. 60 (Meklong).—Koumans, 1937a, p. 63 (Peninsular Siam).

Otherwise known only from Burma, this species is simply listed by Suvatti from the Meklong but it is definitely reported by Koumans from Takuapa, on the west side of Peninsular Thailand, two specimens, 7 and 7.8 cm. long, having been examined in a collection of Thailand fishes sent to the Natural History Museum in Basle, Switzerland, by Dr. H. Bernatzik. Several specimens collected from time to time for the Siamese Bureau of Fisheries in Peninsular and Northern Thailand did not agree closely with *L. octocirrhus* and seemed closer to *L. berdmorei* than to any other species.

LEPIDOCEPHALUS TAENIATUS Fowler

Lepidocephalus taeniatus FOWLER, 1939, p. 63, figs. 11, 12 (Trang).

This small form, described from seven specimens from a waterfall stream near Trang, differs from all the other local species in the reduced number of scales in the lateral series, as indicated in the key.

The type and largest example is 5 cm. long.

Genus ACANTHOPSIS van Hasselt

Acanthopsis VAN HASSELT, *in* Férussac, Bull. Sci. Nat., vol. 2, p. 377, 1824. (Type, *Acanthopsis dialuzona* van Hasselt.)

ACANTHOPSIS CHOIRORHYNCHOS (Bleeker)

FIGURE 60

Cobitis choirorhynchos BLEEKER, 1854 (106), p. 95 (Palembang, Sumatra).
Acanthopsis choerorhynchus BOULENGER, 1903, p. 303 (Patani River).
Acanthopsis choirorhynchos FOWLER, 1935a, p. 106, figs. 35–42 (Khao Nam Poo); 1937, p. 152 (Bangkok, Pitsanulok, Mepoon, Tachin, Kemarat); 1939, p. 59 (Trang).

This species of grotesque physiognomy inhabits Burma, Malaya, Sumatra, Borneo, Java, and French Indo-China, as well as Thailand. It was first recorded from the latter country in 1923. While this fish attains its largest size in swift, clear streams with sandy or gravelly bottom, it is found also in large rivers like the Menam Chao Phya and the Meklong, and in swamps and their outlets, such as the narrow swift streams draining Bung Borapet. Localities represented by specimens collected for the Siamese Bureau of Fisheries are: Central Thailand—Menam Chao Phya at Bangkok, Nakon Sawan, and Paknampo; Menam Nan near Paknampo; Bung Borapet; Meyom at Prae; Meklong at Rajaburi and the west branch of the Meklong far north of Kanburi. Eastern Thailand—Menam Mun near Korat. Peninsular Thailand—Ronpibun (pond), Nam Tadi in Nakon Sritamarat. Southeastern Thailand—Nong Khor and Chanta-

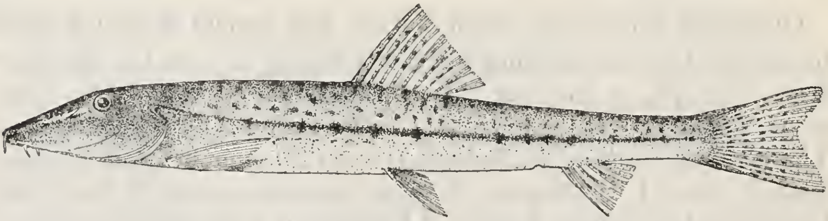


FIGURE 60.—*Acanthopsis choirorhynchos* (Bleeker). Drawn by Luang Masya; courtesy of the Thailand Government.

bun River. Additional localities for specimens in the British Museum are the Mewang, Central region, collected by Vernay, and the Patani, Peninsular district, collected by Annandale and Robinson. Material studied by Fowler came from Bangkok, Pitsanulok, Khao Nam Poo, the Mepoon in Central Thailand, and the Mekong at Kemarat in Eastern region. In collections by Deignan, this species was obtained from the Nan River at Nan, the Meping at Chiengmai, and the Mechem, a tributary of the Meping.

The largest specimens examined were 22.5 cm. long. Full maturity is attained at a much smaller size; thus, a fish 6 cm. long from the Meyom at Prae, Central Thailand, June 28, 1927, contained ripe eggs. No observations on spawning habits have been made.

Eight color variations in fish from Khao Nam Poo, Central Thailand, are given by Fowler (1935a). Many other types of color variations occur, including a pale body with no mark except a narrow dark longitudinal stripe, which may be wholly or partly lacking.

The general color and markings serve to afford the fish concealment in clear, shallow, sandy streams. In some cases the writer was able to determine the presence of the fish most readily by the shadows they cast on the light sandy or gravelly bottom. Where there is current the fish always head upstream. When they are frightened they bury themselves in the bottom sand with great rapidity.

Vernacular names borne by the fish are *pla sai* (sand fish), *pla son sai*, *pla kluey* (banana fish), and *pla rak kluey*.

NEACANTHOPSIS, new genus

Similar to *Acanthopsis* but with the eyes mostly in the anterior half of the head, the concealed bifid spine partly suborbital and partly preorbital and extending under middle of eye, and incomplete lateral line. Body slender and strongly compressed; head compressed; snout contracted, overhanging the small mouth; 3 pairs of barbels (1 rostral, 2 maxillary); eyes subcutaneous; scales minute, deficient on head; dorsal fin beginning over base of ventrals, its branched rays in reduced number (8 against 10 or 11 in *Acanthopsis*); caudal fin truncate (forked or emarginate in *Acanthopsis*).

Genotype.—Neacanthopsis gracilentus, new species.

This genus differs from *Lepidocephalus* chiefly in having no scales on vertex or other parts of head and only one pair of rostral barbels.

NEACANTHOPSIS GRACILENTUS, new species

FIGURE 61

Description.—Very elongate, head and body strongly compressed; depth 7.3 times in standard length; length of caudal peduncle two times its depth and equal to depth of body; head 5 in length, its dorsal profile from nape to tip of snout evenly curved, its width 0.6 its depth; snout strongly compressed, less than 0.5 length of head, slightly overhanging the mouth; bifid spine inserted under and slightly anterior to the eye, its larger prong extending to a point under pupil; nostrils nearer to tip of snout than to eye, the anterior nostril in a short tube with a fringed margin, the opening inclined obliquely forward; posterior nostril simple, elongate; eye almost wholly in anterior half of head, touching dorsal profile, two in snout, five in head and two in interorbital space; mouth very small, strongly arched, its width less than diameter of eye; six subequal barbels, one rostral pair on front of snout, two maxillary pairs somewhat less than diameter of eye, one arising from groove over posterior part of maxillary, one from groove at posterior end of maxillary.

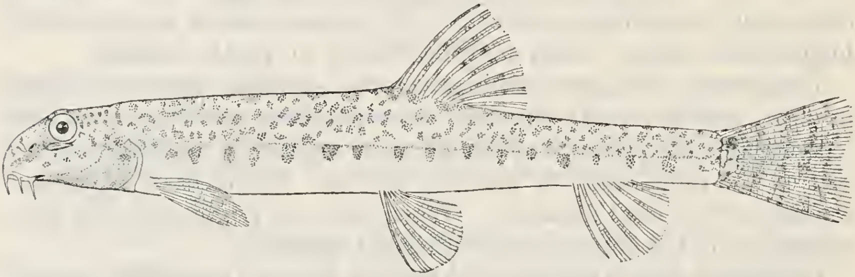


FIGURE 61.—*Neacanthopsis gracilentus*, new species: Type (U.S.N.M. No. 107952). Drawn by Mrs. Aime M. Awl.

Squamation: Scales minute, none on head; lateral line present only on anterior fourth of body.

Fins: Origin of dorsal nearer base of caudal than tip of snout, over base of ventrals; dorsal rays ii,7, longest ray 0.8 head; caudal fin 0.9 head, its posterior margin truncate; anal rays ii,5, longest ray 0.7 head; ventral rays 7, longest 0.7 head; pectoral rays i,9, longest 0.6 head.

Coloration (in preservative): Generally pale yellowish brown; a series of about 16 small roundish dark brown spots along axis of body; back vermiculated with brown, and about 13 dark brown spots on the middle of the back between head and caudal fin; top of head spotted with brown; a series of 5 or 6 small round dark brown spots along side of head under eye; caudal fin with 6 obscure cross bands of dark brown spots, a small round glistening black spot on the upper base of the fin, and a much less distinct corresponding brown spot on the lower base of the fin; fins otherwise plain. In life the black spot on the upper caudal base was surrounded by pale orange and the caudal fin was pale red, with dark brown spots on the rays.

Type and paratypes.—The type (U.S.N.M. No. 107952) is a female, 6.1 cm. long, with well-developed eggs, taken January 28, 1932, in the Meping, north of Chiengmai, Northern Thailand. A specimen 4.9 cm. long was taken at the same time and place. A third specimen 5.2 cm. long was collected by H. G. Deignan April 28, 1935, in the Meping at Chiengdao. Paratypes bear the following U.S.N.M. numbers: 109751, 109752.

Remarks.—This species resembles *Acanthopsis choirorhynchos* (Bleeker), but has a less elongate and more decurved snout, more advanced position of the eye, different position of the bifid preorbital spine, incomplete lateral line, different shape of the caudal fin, and different coloration.

As far as is known at present, the fish inhabits only the upper Meping.

Genus ACANTHOPHTHALMUS van Hasselt

Acanthophthalmus van Hasselt, Alg. Konst. Letterbode, vol. 2, p. 132, 1823. (Type, *Acanthophthalmus fasciatus* van Hasselt.)

This genus is sparsely represented in Thailand as regards both species and individuals. One of the two species thus far recorded is known only from Peninsular Thailand, the other has been found only in Southeastern Thailand. The two may be readily distinguished by their coloration and by the following features:

1*a*. Body and head uniform reddish brown, lighter below; dorsal fin terminating the length of its own base in advance of anal fin________________ javanicus

1*b*. Body and head with 12 to 15 alternating cross bands of red and black; dorsal fin terminating over or very slightly in advance of anal fin_________ kuhlii

ACANTHOPHTHALMUS JAVANICUS Bleeker

Acanthophthalmus javanicus Bleeker, 1860 (265a), p. 75 (Java, Sumatra).

This species has been recorded from Java and Sumatra. Its claim to a place in the Thailand fauna rests on a single diminutive specimen, 2.5 cm. long, taken by the author in Nam Tan Boh, a mountain brook in the Patalung district of Peninsular Siam, July 8, 1929, and on 11 specimens, 3.3 to 5.3 cm. long, taken by H. G. Deignan in the Menam Kon, a branch of the Menam Nan, at Ban Khana, Northern Thailand, April 20, 1936. These specimens agree very well with the description and figure of Bleeker, who records a length of 8.1 cm.

Weber and de Beaufort regarded *A. javanicus* as a synonym of *A. pangia* (Hamilton) from India and Burma. In this conclusion the present author cannot concur. If the figure of the *A. pangia* given by Day is at all accurate, it has the dorsal base about 2.5 times its length in advance of the anal and the origin of the ventral fins much nearer to the tip of the snout than to the base of the caudal fin. In *A. javanicus* the dorsal is not more, and in Bleeker's figure is less, than its base length in advance of the anal and the ventral origin is nearer to the base of the caudal than to the tip of the snout by the length of the head.

ACANTHOPHTHALMUS KUHLII (Cuvier and Valenciennes)

FIGURE 62

Cobitis kuhlii CUVIER and VALENCIENNES, 1846, vol. 18, p. 77 (Batavia).
Acanthophthalmus kuhlii SAUVAGE, 1881, p. 164 (Chantabun).—FOWLER, 1934a, p. 101 (Chantabun).
Acanthophthalmus kuhli SMITH, 1933a, p. 78 (Nong Khor and Kao Sabap).

This species, previously known from Java, Borneo, Sumatra, Singapore, and Malacca, was first ascribed to the Thailand fauna in 1881 when it was reported from Chantabun by Sauvage. In 1927, Layang Gaddi, collector for the U. S. National Museum, obtained 11 specimens in the lake known as Nong Khor, Southeastern region. In April of the same year Luang Masya Chitrakarn, of the Siamese Bureau of Fisheries, obtained 2 specimens in a stream on Kao Sabap, and in January 1929 another specimen was caught in another stream on the same mountain at about 1,000 feet elevation.

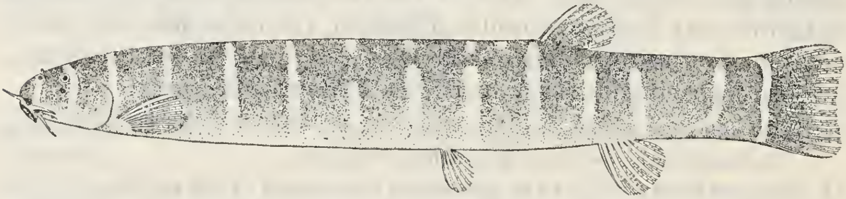


FIGURE 62.—*Acanthophthalmus kuhlii* Cuvier and Valenciennes. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Thailand specimens have ranged from 4.5 up to 8 cm., which seems to be the maximum length attained.

This is one of the most beautiful of the local loaches. The greatly elongated body is marked by broad transverse bands of black and red.

The people on Kao Sabap know this fish and give it a special name, *pla prong oy* (sugarcane-joint fish).

Genus COBITOPHIS Myers

Cobitophis MYERS, Amer. Mus. Novit., No. 265, p. 4, 1927. (Type, *Acanthopterus anguillaris* Vaillant.)

The genus *Cobitophis* was established by Myers for *Acanthophthalmus anguillaris* (Vaillant) and *A. vermicularis* (Weber and de Beaufort), which "differ sharply from the others of the genus in the extremely attenuated, anguilliform body, and in having some part of the anal fin under the dorsal."

COBITOPHIS ANGUILLARIS (Vaillant)

Acanthophthalmus anguillaris VAILLANT, 1902, p. 151 (Kapoeas, Borneo).—FOWLER, 1934a, p. 103 (Chiengmai).

Previously known only from Borneo, this species was first detected in Thailand in July 1928 when a specimen was taken in a ditch near the town of Chantabun, Southeastern region. In September 1932 it was found in Bung Borapet, Central area, and in December 1932 numerous specimens were collected in the Meping at Chiengmai, Northern Thailand.

The largest examples exceed 9 cm. in length; the average is about 7 cm. The bifid suborbital spine is sharp and comparatively large.

The fish is very numerous in Bung Borapet and in the Meping in the vicinity of Chiengmai. Examples from Bung Borapet taken to Bangkok were kept alive for months in a small jar of water. In a thin layer of sand and gravel they completely disappeared and were not observable unless disturbed, when they would swim about very actively for a few moments with a wriggling motion and again quickly bury out of sight. The skin is slippery like that of an eel, and when the fish were put in alcohol a large amount of mucus was precipitated. The fish was not fed but remained in good condition apparently from the ingestion of minute animal or plant life in water and sand.

The respiratory movements are peculiar. In a vessel with no bottom material in which the fish could hide, the movement of the gill covers could be observed. This movement was sometimes so rapid and strong that the entire head quivered. At other times, when the fish were undisturbed and resting quietly with the head on gravel. respiration would be suspended for 5 to 10 seconds, then resumed with 5 to 15 movements, then suspended again, the pectoral fins all the time remaining motionless and closely applied to the abdomen.

Color in life: Back and top of head varying from pale bluish gray to pale reddish brown with minute blackish spots; a narrow sharply defined black stripe along the side of the body, extending on head to eye and snout and on median caudal rays where it spreads like a fan; side pale blue without minute spots; belly pinkish white; iris orange; a glistening golden-green area on opercle; dorsal pale yellow, with black on the rays; anal and other fins hyaline.

Specimens from Northern Thailand showed differences from Vaillant's figure (as reproduced by Weber and de Beaufort, 1916) as regards the relative position of the dorsal and anal fins, and suggested possible agreement with *Acanthopthalmus vermicularis* of Weber and de Beaufort from Sumatra, a species based largely on the position of those fins. The U. S. National Museum therefore donated specimens from the Meping to the Royal Museum of Natural History in Leiden, depository of Vaillant's type, and to the Zoological Museum in Amsterdam, depository of the type of *A. vermicularis*, with the request that comparison be made with the types. Dr. Frederik P. Koumans, curator of fishes in the Royal Museum of Natural History in Leiden, kindly examined the type of *A. anguillaris* Vaillant and also the type of *A. vermicularis*, sent to him from Amsterdam, and gave the results of his comparisons in a letter dated July 1, 1937. The Thailand specimens were found to agree with the type of *A. anguillaris*. The original figure of that species (reproduced in Weber and de Beaufort) was faulty in showing the insertion of the last dorsal ray above the insertion of the last anal ray, whereas in the type the base of the last dorsal ray is above the insertion of the first branched anal ray; and no differences were disclosed in the types of *A. anguillaris* and *A. vermicularis*, the latter thus becoming a synonym.

Fowler (1934a) very properly notes that the writer misidentified as *Eucirrhichthys doriae* specimens of this species collected in the Meping at Chiengmai, in Bung Borapet, and elsewhere.

Genus ACANTHOPSOIDES Fowler

Acanthopsoides FOWLER, Proc. Acad. Nat. Sci. Philadelphia, 1934, p. 103. (Type, *Acanthopsoides gracilis* Fowler.)

ACANTHOPSOIDES GRACILIS Fowler

Acanthopsoides gracilis FOWLER, 1934a, p. 103, fig. 55 (Chiengmai, Chiengsen).

The type of this species, from the Meping at Chiengmai, Northern Thailand was 5.4 cm. long. Numerous (66) other specimens from the Meping and from the Mekong at Chiengsen were from 2.5 to 5.3 cm. long. The principal characters separating *Acanthopsoides* from *Acanthopsis* are the position of the eye in the anterior half of the head, the insertion of the dorsal fin in the posterior half of the body, and the origin of the ventral fins before the origin of the dorsal. A feature that Fowler emphasizes as distinctive is a small, round jet-black spot at the base of the upper half of the caudal fin, but this spot is normally present in *Acanthopsis choirorhynchos* (Bleeker).

Genus NOEMACHEILUS van Hasselt

Noemacheilus VAN HASSELT, Alg. Konst. Letterbode, vol. 2, No. 35, p. 133, 1823. (Type, *Noemacheilus fasciatus* van Hasselt.) [Most authors working with this group of fishes have spelled the name of the genus *Nemachilus* after Günther's amended spelling in the Catalogue of Fishes in the British Museum, vol. 7, pp. 11, 347, 1868, but the original spelling by van Hasselt is *Noemacheilus*.—L. P. S.]

In the forested mountains of Thailand loaches of the genus *Noemacheilus* abound in very small, shallow, swift, clear, cool streamlets with sandy or gravelly bottoms. As a person approaches such streams quietly so as not to disturb the fishes, he may see none, and on a number of occasions, when no loaches were visible but subsequent events proved them to be present in abundance, it seemed that they might be largely nocturnal and thereby protected from some of their natural enemies. The mountain people, who are very fond of eating loaches and other small fishes, spend considerable time and labor on tiny streams that would be regarded by the uninitiated as hopeless fishing grounds. The method of procedure is to place a dam of stones and earth, sometimes supplemented by leaves, twigs, or branches, across a streamlet, diverting its course into an old bed, or into a new bed that may be prepared by removing stones and building up little banks of gravel, sand, or earth. In the bed thus left dry, the gravel and sand are scooped up with the hands, coconut shells, or other implements, and the fish are disclosed. A short stretch of exposed streamlet bed, about a meter wide and 10 to 15 meters long, has yielded scores of loaches, mostly *Noemacheilus.*

In a scholarly revision of the fishes of the genus *Noemacheilus* recorded from Burma, Hora (1929a, p. 311) made the following remarks, which apply also to Thailand:

> Among the Indian freshwater fishes there are few genera whose taxonomy is involved in such great confusion as that of *Nemachilus.* This is in part due to the fact that many of the species exhibit considerable individual variability. Moreover, most of the specific standards, such as number of fin-rays, scale counts, body proportions, colouration, etc., which are used in distinguishing species of most of the other Cyprinoid genera, are of very little significance in the case of *Nemachilus.* Fortunately most of the Burmese species are very peculiar and, therefore, little difficulty has been experienced in characterizing them. In distinguishing closely allied species I have relied on the character of the lateral line, the position of the anal opening with regard to the ventrals and the position of the commencement of the dorsal with regard to its distance from the tip of the snout and the base of the caudal.

The species of *Noemacheilus* from Thailand may be differentiated as follows:

1*a*. Body marked by numerous transverse bands or saddles.
  2*a*. Cross bands black or dark brown.
    3*a*. A narrow cross band at base of caudal fin.
      4*a*. Dark cross bands on body 6 to 9.
        5*a*. Lateral line complete.
          6*a*. Cross bands 6 or 7, their width about equal to interspaces, 2 predorsal, 2 subdorsal, 2 or 3 postdorsal; a small black spot at anterior base of dorsal fin; head plain___________ fowlerianus
          6*b*. Cross bands 7, wider than interspaces, 2 predorsal, 2 wholly or partly subdorsal; 3 postdorsal; 2 black spots at base of dorsal fin; upper surface of head with dark spots, a dark preorbital blotch____ thai

6*c*. Cross bands 8 or 9.

7*a*. Head long, 0.25 standard length or longer; snout not abruptly declined; cheeks not dilated.

8*a*. A preorbital hook (in male); cross bands wider than interspaces, 3 predorsal, 2 wholly or partly subdorsal, 4 postdorsal; 3 transverse rows of dark spots on dorsal fin; 2 rows of dark spots on anal fin; paired fins with several rows of dark spots; top of head dark spotted; caudal fin deeply emarginate---------------------------- **myrmekia**

8*b*. No preorbital hook reported.

9*a*. Cross bands rather regular, 2 or 3 predorsal, 2 or 3 wholly or partly subdorsal, 3 postdorsal; a row of dark spots across midlength of dorsal fin; upper surface of head plain brown---------------------------------- **desmotes**

9*b*. Cross bands very irregular, mostly broken into spots and blotches, only 2 or 3 regular bands under or immediately posterior to dorsal fin; upper surface of head, including snout, with round dark spots---------------- **spilotus**

7*b*. Head short, less than 0.25 standard length; snout abruptly declined; cheeks dilated; cross bands 9, 3 predorsal, 2 wholly or partly subdorsal, 4 postdorsal; top of head obscurely mottled; cheeks plain; dorsal fin with rays dark brown and 2 conspicuous black spots at base------------------ **breviceps**

5*b*. Lateral line incomplete, extending only to opposite anterior part of anal base; origin of dorsal fin anterior to base of ventrals; cross bands 7, wider than interspaces, 2 predorsal, 2 wholly or partly subdorsal, 3 postdorsal; a conspicuous black spot at base of anterior dorsal rays, a brown spot at base of posterior dorsal rays, with a bright orange area between; top of head vermiculated--- **nicholsi**

4*b*. Dark cross bands 7 to 14, usually about 10; lateral line complete; scales deficient; nasal tentacle short, not reaching eye; snout rather long (2.5 in head), bluntly pointed, its profile not strongly arched; head dark brown or blackish; caudal peduncle slightly longer than deep; branched dorsal rays 8------------------------------ **menanensis**

4*c*. Dark cross bands 10 to 18.

10*a*. Nasal tentacle short, not reaching eye.

11*a*. Snout short (3.6 in head), very blunt, its profile strongly arched; head black; 10 to 12 rather obscure cross bands, 4 or 5 predorsal, 2 or 3 subdorsal, 3 or 4 postdorsal; caudal peduncle as deep as long; branched dorsal rays 9---------------------- **atriceps**

11*b*. Snout longer (2.5 to 3 in head), its profile not strongly arched; head not black or dark brown; branched dorsal rays 8.

12*a*. Ten or 11 dark brown cross bands about width of interspaces, 4 predorsal, 2 or 3 subdorsal, 4 or 5 postdorsal; top of head without black spots; origin of dorsal fin nearer to base of caudal fin than to tip of snout; width of head 1.5 in its length; caudal peduncle as deep as long----------------------- **reidi**

12*b*. Eleven dark brown cross bands wider than interspaces, 4 predorsal, 2 subdorsal, 5 postdorsal, those under and before dorsal fin wider, irregular, and oblique; top of head with small black spots; origin of dorsal fin nearer to base of caudal fin than to tip of snout; width of head 1.25 in its length; caudal peduncle as deep as long--------- **sexcauda**

12*c*. Thirteen dark brown cross bands wider than interspaces, 5 predorsal, 3 subdorsal, 5 postdorsal, the bands not sharply defined; top of head without black or dark spots; origin of dorsal fin midway between tip of snout and base of caudal fin; width of head 1.1 in its length; caudal peduncle as deep as long -- obscurus

12*d*. Thirteen dark brown cross bands about width of interspaces, each band with a narrow darker margin, 5 predorsal, 3 subdorsal, 5 postdorsal; top of head with obscure dark spots; origin of dorsal fin nearer to base of caudal fin than to tip of snout; width of head 1.4 to 1.87 in its length; caudal peduncle deeper than long ------------------------ waltoni

12*e*. Fourteen to eighteen black cross bands about width of interspaces, usually 5 predorsal, 3 subdorsal, and 7 postdorsal; top of head mottled; dorsal fin with a jet black spot at its anterior base and another at its midbase; origin of dorsal midway between tip of snout and base of caudal fin; width of head 1.4 in its length; caudal peduncle as deep as long -- schultzi

10*b*. Nasal tentacle long, reaching to middle of eye; 13 dark brown cross bands wider than interspaces, 6 predorsal, 2 subdorsal, 5 postdorsal; origin of dorsal fin midway between nostrils and base of caudal fin; width of head 1.4 in its length; caudal peduncle deeper than long -- deignani

4*d*. Dark cross bands on body 17 to 23.

13*a*. Lateral line incomplete, terminating anteriorly to anal fin; origin of dorsal fin over base of ventral fins; cross bands 17, about width of interspaces, 6 predorsal, 3 subdorsal, 8 postdorsal, together with a black band at base of caudal fin; a black area at beginning of lateral line extending to axil of pectoral------ kohchangensis

13*b*. Lateral line complete; origin of dorsal fin in advance of base of ventrals; cross bands about 23, about width of interspaces, the bands anterior to and under dorsal fin about 18, much narrower than those posterior to fin which number 5, together with a narrow black band at base of caudal fin------------- multifasciatus

4*e*. Dark cross bands on body about 34; lateral line complete; origin of dorsal fin over base of ventrals; cross bands under and before dorsal fin about 25, much narrower than postdorsal bands, which number about 9; predorsal region with about 6 dark brown transverse saddles; at base of caudal fin a crescentic or lunate jet-black band not reaching dorsal and ventral profiles, near its upper end a black saddlelike spot on caudal fulcra------------------------- poculi

3*b*. No black cross band at base of caudal fin; a jet-black spot at midbase of caudal rays in a yellow area; back with 14 to 20 dark saddles, side with same number of dark spots along lateral line; body slender, depth 7 in standard length; all barbels longer than in other local species; a preorbital hook (in male); caudal fin deeply forked, lobes pointed, upper lobe longer------------------------------------ masyae

2*b*. Cross bands narrow, pale, 11 to 14, separated by much wider dark brown interspaces; a conspicuous black bar below eye; all barbels comparatively long; caudal fin much longer than head, deeply forked, lobes pointed --- translineatus

1*b*. Body not marked by transverse bands or saddles.
  14*a*. Body plain; head greatly depressed; cheeks much dilated; size comparatively large ---------- bucculentus
  14*b*. Body with a black longitudinal stripe extending from head to base of caudal fin; from upper margin of this stripe, over pectoral fin, extend 2 short vertical black bars in a yellow area; head conical; cheeks not dilated; size comparatively small ---------- binotatus

NOEMACHEILUS FOWLERIANUS, new species

Nemacheilus beavani (*non* Günther), FOWLER, 1937, p. 156, fig. 80–87 (Mepoon).

Describing *Nemacheilus beavani* from a specimen 2 inches long from Bengal, Günther (1868, vol. 7, p. 350) did not satisfactorily differentiate the species. He gave nine dark cross bands in addition to a black streak across the base of the caudal, and blackish dots on dorsal and caudal rays; depth five; head less than four; caudal peduncle as deep as long; caudal fin slightly emarginate; pectoral fin extending two-thirds to ventrals; origin of dorsal midway from tip of snout to base of caudal.

The figure of *N. beavani* published by Day (1878, vol. 2, pl. 156, fig. 8) does not agree with his own description of the species or with Günther's description; for example, while the species was said by Day to have 9 dark cross bands wider than the interspaces, his figure of a specimen from Madras shows 13 or 14 dark cross bands, of which the 4 or 5 anterior to the dorsal fin are represented as narrower than the interspaces.

Under the name *Nemacheilus beavani*, Fowler (1937) listed eight species, 3.5 to 4.2 cm. long, of a *Noemacheilus* from Mepoon, Central Thailand, and figured all of them to show variations in coloration. These specimens had, in addition to a narrow black band at the base of the caudal fin, six or seven dark cross bands (including spots occupying the position of bands), and did not agree with Günther's account in this respect and in the relative width of the cross bands and interspaces. According to Fowler there are only two postdorsal bands, but some of his figures (80, 81, 82, 86) show two bands and a spot, the spot being variable in position and taking the place of either the second or the third band; the spot is, in fact, an incomplete band.

For the foregoing and other reasons, it is not possible to reconcile *Nemacheilus beavani* of Fowler with Günther's species, and it is therefore proposed to recognize the fish that Fowler illustrated so fully as a new form under the name *Noemacheilus fowlerianus*. The holotype is in the Academy of Natural Sciences of Philadelphia (No. 69961), as are five paratypes (Nos. 69962–69966). Two paratypes (U.S.M.M. No. 119700) are in the U. S. National Museum.

NOEMACHEILUS THAI Fowler

Nemacheilus thai FOWLER, 1934a, p. 104, fig. 56 (Bua Yai, Chiengmai); 1937, p. 156 (Mepoon).

This species, described from a specimen, 4.6 cm. long from Bua Yai in Eastern Thailand, is reported also from Northern and Central Thailand, the largest examples being 5.9 cm. long. The body is marked by seven wide dark brown cross bands, two predorsal, two wholly or partly subdorsal, and three postdorsal, together with a narrow black vertical stripe at the caudal base. The dorsal rays have a median dark spot and the caudal has several indistinct transverse rows of dark spots.

N. thai is very similar to *N. nicholsi* in form and in the number and position of the cross bands and in the dark blotching or marbling of top of head. Minor differences are seen in the marking on caudal, anal, and ventral fins. The lateral line is described as complete, while in *N. nicholsi* it is deficient posteriorly.

NOEMACHEILUS MYRMEKIA Fowler

Nemacheilus myrmekia FOWLER, 1935a, p. 106, fig. 32 (Keng Sok).

This species is known from one specimen, 5.8 cm. long. There are nine dark brown cross bands, of which three are predorsal, three wholly or partly subdorsal, and three postdorsal. If the species is distinct from *N. desmotes*, the differences may be in the shorter rostral barbels, the dark brown spots on top of head, the additional rows of spots on dorsal ray, and the spotted lower fins. A preorbital "wart-like flap or spine" possessed by the type is probably not of specific significance but is a secondary sexual character borne by various species of *Noemacheilus*.

NOEMACHEILUS DESMOTES Fowler

Nemacheilus desmotes FOWLER, 1934a, p. 107, fig. 59 (Chiengmai); 1937, p. 156, figs. 88–95 (Mepoon).

This species was described from a specimen 2.8 cm. long, with a paratype 2.4 cm. long. Later 10 specimens 2.8 to 5.2 cm. long were recorded from Mepoon, and figures of 8 of these were published. The type showed 8 dark cross bands posterior to the head, excluding a black bar on the base of the caudal fin, the bands broad, with regular sides and wider than the interspaces, 2 predorsal, 3 wholly or partly subdorsal, and three postdorsal. The series of figures exhibits considerable departure from the type as regards the cross bands, which are irregular in shape, position, and number; thus, 3 of the 8 figures show 9 complete or incomplete bands, and 5 of them have 3 predorsal bands.

Specimens collected by Deignan in the Menam Mao agree fairly well with the descriptions and figures of this species; they are 5.6 and 5.9 cm. long.

NOEMACHEILUS SPILOTUS Fowler

Nemacheilus spilotus Fowler, 1934a, p. 105, fig. 57 (Chiengmai, Chiengdao, Metang, Khun Tan).

Known from numerous specimens, 3.4 to 11.2 cm. long, from various places in Northern Thailand. The body is marked by seven to nine irregular transverse dark bands, those anteriorly and posteriorly broken into spots or blotches. The dorsal arises very slightly in advance of ventrals and much nearer to tip of snout than to base of caudal fin.

Fowler (1934a) says: "Characteristic of this species is the dark or black band transversely close before the caudal base," the band elsewhere being referred to as "at caudal base." As a matter of fact, however, this band is present in a dozen or more Thai and Indian species.

Fifteen specimens 6.0 to 9.2 cm. long were taken by the Harvard Primate Expedition on Doi Angka, April 1937. These agree rather closely with the originally described specimens from various places in the Meping drainage.

NOEMACHEILUS BREVICEPS, new species

Figure 63

Description.—Rather robust; body moderately compressed posteriorly, cylindrical anteriorly, depth 5.0 in standard length; caudal peduncle broad, slightly longer than deep, its length 1.8 in head; head rather short, broad, moderately depressed, its length 4.1 in standard length, its width 1.3 in its length; head behind eyes with straight profile continuous with that of back; snout strongly decurved, broad, blunt, its length 2.3 in head, and eye 2.5 times in snout; eye touching dorsal profile of head, small, in anterior half of head, 6 in head, 1.6 in flat interorbital space; nostrils nearer to eye than to tip of snout, anterior nostrils in a short tube with well-developed pointed flap, which when depressed does not reach eye; mouth lunate, lips rather thick and fleshy, lower lip with a deep median incision, width of mouth 2.5 times diameter of eye; inner rostral barbel one-fourth shorter than outer barbel, extending to vertical from nostrils; outer rostral barbel reaching vertical from between nostrils and eye; maxillary barbel one-fourth longer than outer rostral, extending to vertical from behind eye; cheeks somewhat dilated.

Squamation: Lateral line complete; rudimentary embedded scales on posterior half of body, deficient on abdomen and anterior to dorsal fin.

Fins: Origin of dorsal fin over origin of ventrals, a little closer to base of caudal fin than to tip of snout; rays iii,8, longest rays slightly more than half length of head; caudal fin moderately emarginate, somewhat shorter than head; anal rays ii,5, longest equal to longest dorsal rays; ventrals reaching anal opening, rays i,7; pectorals 1.5 times as long as ventrals, 1.2 in head, rays i,10.

Coloration: General color pale creamy yellow; body with nine dark brown cross bands meeting over back, equal to or wider than interspaces, three predorsal, two wholly or partly subdorsal, four postdorsal, together with a narrow jet-black cross band at base of caudal fin; top of head mottled, cheeks yellowish brown; dorsal fin with two large black spots at base, rays brownish, membranes hyaline; other fins plain.

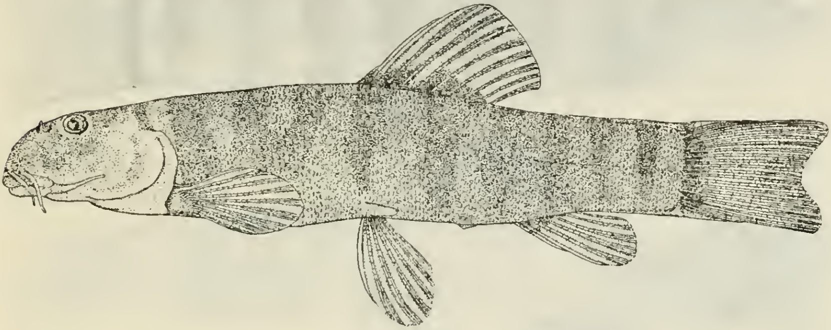


FIGURE 63.—*Noemacheilus breviceps*, new species: Type (U.S.N.M. No. 117751). Drawn by Mrs. Alice C. Mullen.

Type.—A specimen (U.S.N.M. No. 117751), 7.2 cm long, taken by H. G. Deignan December 26, 1936, in the Menam Mao, a tributary of the Menam Fang, an affluent of the Mekong, Northern Thailand.

Remarks.—At the place and time of capture of this specimen, the Menam Mao was a clear torrent at the foot of a mountain.

The species is characterized by its comparatively short head, abruptly decurved snout, swollen cheeks, small eyes, short barbels, and pattern of coloration. Its relations with other local species are shown in the key.

NOEMACHEILUS NICHOLSI H. M. Smith

FIGURE 64

Nemacheilus nicholsi SMITH, 1933a, p. 53, fig. 1, pl. 1, fig. 1 (Pak Jong).—FOWLER, 1934a, p. 105 (Bua Yai).

Originally known only from a small mountain stream, tributary of the Menam Mun, near Pak Jong, Eastern Thailand, this fish has since been found at Bua Yai, also in Eastern Thailand. Two specimens 4.3 and 4.7 cm. long were taken in Lam Tong Lang, a tributary of the

Pasak in Central Thailand; the larger fish contained large eggs. The species is characterized by seven wide, dark brown cross bands, which meet dorsally and extend entirely across the body, two of the bands being predorsal, one partly predorsal and partly subdorsal, one subdorsal and three postdorsal, with a narrow black vertical bar at base of caudal fin; short rostral barbels, none reaching eye; eight branched dorsal rays; and lateral line deficient on the caudal peduncle.

The largest specimen, the type, was 5 cm. long.

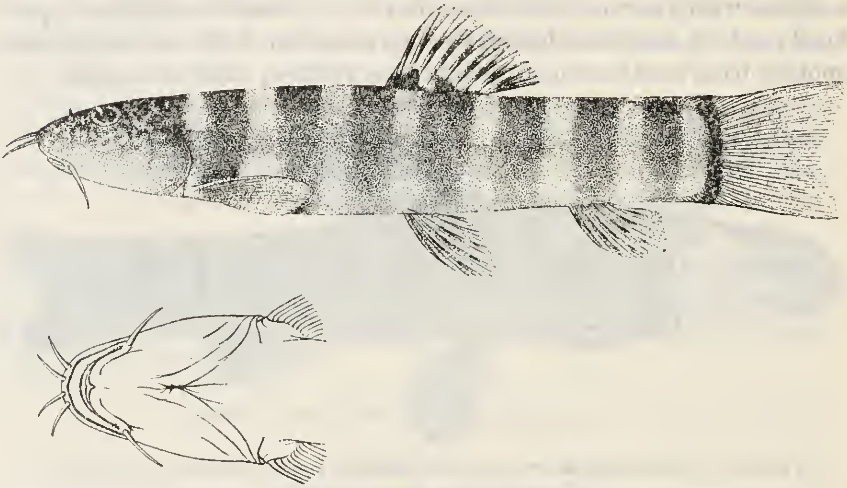


Figure 64.—*Noemacheilus nicholsi* H. M. Smith. Drawing by Luang Masya; courtesy of the Thailand Government.

NOEMACHEILUS MENANENSIS, new species

Figure 65

Description.—Form comparatively slender, body moderately compressed posteriorly, cylindrical anteriorly; depth 6.0 in standard length; length of caudal peduncle 0.7 head and slightly more than its depth; head 4.1 in length, bluntly pointed when viewed from above, depressed, its width 0.7 its length, its depth at nape 0.6 its length; eye in anterior half of head, 5 in head, 2 in snout, 1.5 in the flat interorbital space; snout 2.5 in head, its profile very slightly convex; nostrils nearer to eye than to tip of snout, the anterior tubular, the acutely pointed flap reaching halfway to eye when depressed; all barbels comparatively short, inner rostral barbel equal to eye, outer rostral barbel 1.5 times length of inner and not extending to vertical from anterior edge of eye, maxillary barbel equal to outer rostral and reaching vertical from posterior edge of eye; mouth small, strongly arched, its width at angles 1.5 times eye, lips moderately fleshy, posterior lip with a slight median incision; upper jaw with median beaklike projection fitting into a depression in lower jaw; lateral line complete; scales deficient.

Fins: Origin of dorsal fin midway between nostrils and base of median caudal rays, over origin of ventrals; dorsal rays ii,8, longest branched ray 0.6 length of head; caudal fin as long as head, moderately emarginate; anal rays ii,5, longest 0.6 head; ventral rays i,7, extending to anal opening, 0.7 length of head; pectoral rays i,10, 0.9 length of head, extending 0.6 distance to ventrals.

Coloration: Body dull yellowish brown, with 10 dark brown cross bands wider than interspaces, 4 predorsal, 2 subdorsal, 4 postdorsal, in addition to a narrow black cross band at base of caudal rays; head entirely dark brown to blackish, with exception of a diffused light brown area on cheek, a light edge to the opercular flap, and light yellow or whitish lips and barbels; all fins whitish or yellowish, dorsal and caudal rays pale tan, a small black spot at base of first two dorsal rays, and a dull brownish spot at base of ventral and pectoral fins.

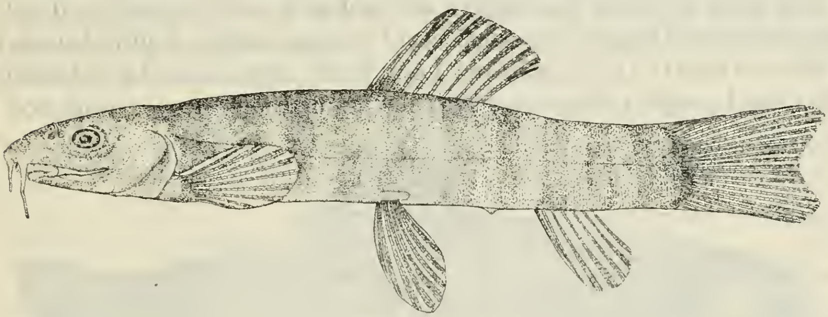


FIGURE 65.—*Noemacheilus menanensis*, new species: Type (U.S.N.M. No. 117753). Drawn by Mrs. Alice C. Mullen.

Type and paratypes.—The type (U.S.N.M. No. 117753), a specimen 5.5 cm. long, was collected by H. G. Deignan on April 20, 1936, in the Menam Kon, a tributary of the Menam Nan, Northern Thailand. Material that may be considered paratypic (U.S.N.M. No. 117752), collected at the same place and time, consists of 32 specimens 2.3 to 5 cm. long.

Other specimens.—A single specimen 6 cm. long was collected in the Huey Lom, an affluent of the Menam Nan, in June 1936.

Remarks.—Distinguishing features of this species are the long, pointed head, short barbels, absence of scales except on back behind dorsal fin, and blackish or dark brown color of the head, this color being in sharpest contrast on the lower surface. The cross bands in the larger specimens are most distinct under and posterior to the dorsal fin, and may be scarcely discernible anteriorly. The usual or average number of cross bands seems to be about 10. In some of the smaller specimens, in which the cross bands show quite distinctly, there is seen considerable variation in number, ranging from 7 to 14. In the few specimens in which the cross bands are as few as 7, they are wide, and the pigmentation is more diffuse than in the specimens having more numerous cross bands.

This species was found in close association with *N. atriceps* and shows a remarkable resemblance thereto in the sharply defined dark head (not met with in other local species) and in the general coloration of body and fins. There is, however, a marked difference in the length of the head, the length and shape of the snout, the width of the mouth, squamation, and number of branched dorsal rays, which are always 8 in this species and 9 in *N. atriceps.*

NOEMACHEILUS ATRICEPS, new species

FIGURE 66

Description.—Body moderately elongate and compressed, profile from nape to dorsal fin slightly inclined and nearly straight; depth 5.3 in standard length, somewhat over 6 in total length; depth of caudal peduncle equal to its length, and 1.4 in head; head short, 4.6 in length, its dorsal profile rising abruptly from tip of snout to eye; head moderately depressed, its depth at nape 1.5 in its length and its width 1.2 in its length; snout short, blunt, strongly arched, evenly rounded when viewed from above, 2.4 in head; eyes extending to dorsal profile, 5.5 in head, 2.1 in snout, 1.8 in the flat interorbital space, and a very little nearer to gill opening than tip of snout; nostrils nearer to eye than to tip of snout, separated by a short flap which does not reach eye; mouth lunate, twice diameter of eye, surrounded by rather thin, broad, flattened lips, lower lip with a slight median incision, the inner ends of the postlabial grooves separated by a space shorter than diameter of eye; outer rostral barbel 1.5 times length of inner barbel, reaching vertical from anterior margin of eye and extending slightly beyond base of

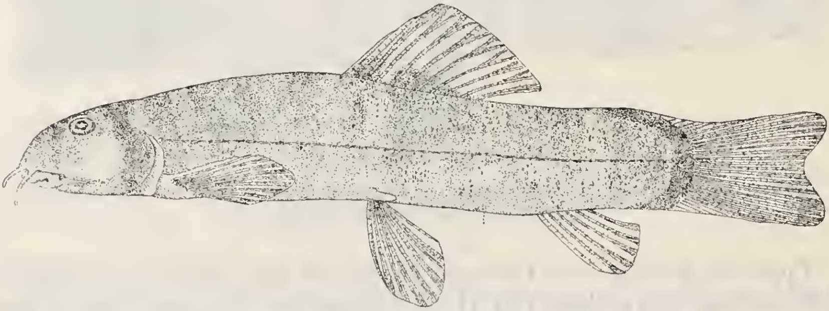


FIGURE 66.—*Noemacheilus atriceps*, new species: Type (U.S.N.M. No. 117750). Drawn by Mrs. Alice C. Mullen.

maxillary barbel, which is equal to outer rostral barbel and reaches vertical from posterior margin of eye; opercles with a broad membranous flap.

Squamation: Lateral line complete; minute scales covering body posteriorly, deficient anteriorly and on abdomen.

Fins: Origin of dorsal fin a trifle nearer to tip of snout than to base of caudal and distinctly in advance of ventrals; dorsal rays ii, 9, longest ray about 1.4 in head and less than depth of body; caudal fin slightly longer than head, moderately forked, lobes rounded; anal rays ii, 5, longest about 1.5 in head; ventral rays i, 7, reaching ventral opening, slightly shorter than pectoral, which has rays i, 12, extending halfway to ventrals, and slightly shorter than head.

Coloration: Reddish brown, lighter below; body marked by rather indistinct dark vertical bands about width of interspaces, four predorsal, three subdorsal, and three postdorsal, together with a curved black band at base of caudal fin; head, with exception of lips and a diffuse light brown area on cheeks, uniform dull black; lips, barbels, and edge of membranous opercular flap whitish; dorsal fin blackish at base, rays dusky green; caudal, and lower fins greenish; a small dull brownish area at the base of ventral and pectoral fins.

Type and paratypes.—The type (U.S.N.M. No. 117750) 6.7 cm. long was collected by H. G. Deignan April 21, 1936, in the Menam Kon, a branch of the Menam Nan, at Ban Khana, Northern Thailand. Paratypes, U.S.N.M. No. 117746, taken April 20, 1936, in the same locality, number 70 and range in length from 2.4 to 6.1 cm.

Remarks.—The watercourse from which the type specimen came was noted by Mr. Deignan as a small, clear, swift mountain stream.

The characters by which the species may be recognized are the small, blunt head, steep rostral profile, short barbels, deep caudal peduncle, small fins, and striking coloration of the head. In the peculiar dorsal profile of the head there is resemblance to the Indian species *N. rupicola* Vaillant and *N. montanus* (McClelland) from the Himalayas.

NOEMACHEILUS REIDI, new species

FIGURE 67

Description.—Form rather elongate; body compressed, its greatest depth 6 times in standard length; length of caudal peduncle equal to its depth and 1.8 times in length of head; 4 in length, head moderately depressed, its depth 0.75 its width, its width 1.5 in its length; eye in midlength of head, 5 in head, 1.7 in interorbital space, and about 2 in snout which is about 2.5 in head; mouth semicircular, lips moderately thick, lower lip medianly incised, upper jaw with a broad median beak fitting against a corresponding incision in lower jaw; inner rostral barbel just reaching nostril, outer rostral barbel extending to front margin of eye, maxillary barbel reaching a little past posterior margin of eye; nasal barbels short, when depressed not extending to eye.

Squamation: Scales embedded, becoming indistinct or deficient on anterior part of body, lateral line complete.

Fins: Origin of dorsal fin nearly over insertion of ventrals, nearer to base of caudal than to tip of snout; dorsal rays ii,8, first branched ray less than 0.5 head; caudal slightly emarginate, less than length of head; anal rays ii,5, longest branched ray 1.8 in head; ventrals extending beyond vent, about 1.5 in head; pectorals slightly longer than ventrals, rays i, 10.

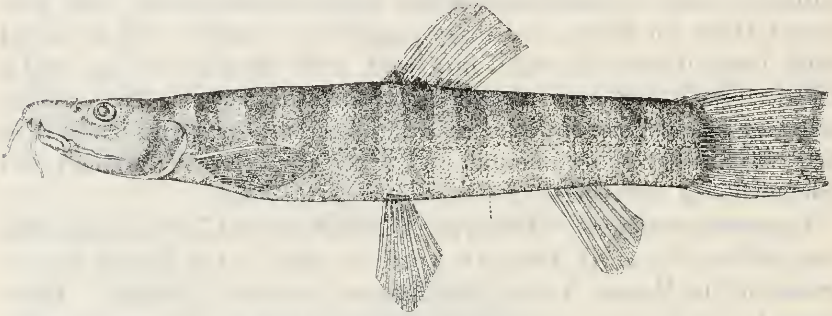


FIGURE 67.—*Noemacheilus reidi*, new species: Type (U.S.N.M. No. 107944). Drawn by Mrs. Alice C. Mullen.

Coloration: General color dull yellowish brown, lighter below; top of head dark brown; body from head to caudal fin with 10 dark brown cross bands about as wide as interspaces, the bands of the two sides meeting on back; four of the bands predorsal, two subdorsal, four postdorsal, together with a black band across base of caudal fin; dorsal fin with a blackish spot at base anteriorly, the rays dark green medianly; caudal fin dusky green; a small dark spot at inferior base of ventral and pectoral fins; fins otherwise plain.

Type and paratypes.—The type, a specimen 8 cm. long (U.S.N.M. No. 107944) was taken October 19, 1936, in Huey Mekong Kha, a mountain torrent at base of Doi Mekong Kha, Northern Thailand. The stream is a tributory of the Salwin. Sixteen other specimens taken at the same place October 19, 20, and 22 are 4 to 8.4 cm. long. Paratypes bear U.S.N.M. Nos. 107908, 107913, 107914, 107918, and 117744.

Other specimens.—Three specimens from the Salwin at Ta Ta Fang, Northern Thailand, October 15, 1936, are 5.5, 6.3, and 6.9 cm. long; the two largest contained ripe eggs. All these specimens, including the type, were collected by H. G. Deignan.

Remarks.—This is a comparatively dull-colored form. The dark cross bands do not stand out prominently as in many other species and anteriorly show a tendency to become faint or almost disappear. There is a slight variation in the number and shape of the cross bands, and there may be a blackish blotch involving the base of the dorsal fin posteriorly.

There is a close resemblance between this species and *N. cincticauda* (Blyth), of Lower Burma. In the latter form, as described in full detail and figured by Hora (1929a), the barbels are subequal, the rostral barbels respectively reach the anterior margin and the middle of the eye, the maxillary barbel extends well behind the eye, and the lateral line is incomplete, ending before the ventral fin.

There is resemblance also between this species and *N. sexcauda*, (q. v.), known from a single specimen 11.6 cm. long from Mepoon. Differences are apparent in the size and position of the eye (entirely in anterior half of head in *sexcauda*), width of head in relation to its length (greater in *sexcauda* than in *reidi*), shape of the mouth (less strongly curved in *sexcauda* and according to Fowler's figure the lower lip lacks the median incision seen in *reidi*), and such characters as the shape and direction of the predorsal and subdorsal cross bands.

The species is as yet known only from a mountain torrent at the foot of Doi Mekong Kha, between Mesarieng and Ta Ta Fang, and from the Salwin at Ta Ta Fang.

It does not appear to fit in with any of the other species recorded from Thailand, Burma, and India. Its principal features are the slender body, short barbels, complete lateral line, posterior position of the dorsal fin, long ventrals, and subdued coloration.

A specimen, 7.5 cm. long, from the type locality shows a regular transverse fold across the isthmus between the attachment of the branchial membranes. In one specimen one of the inner rostral barbels is bifid.

The species is named for E. D. Reid, of the division of fishes in the U. S. National Museum.

NOEMACHEILUS SEXCAUDA Fowler

Nemacheilus sexcauda Fowler, 1937, p. 156, figs. 75, 76 (Mepoon).

This species is known from one specimen, 11.6 cm. long, from Mepoon, Central Thailand. The body is marked by 11 irregular dark brown cross bands, of which 4 are predorsal, 2 subdorsal, and 5 postdorsal, with a narrow black band at base of caudal. The dorsal fin is damaged. The maxillary is described as contained 3 times in length of head, but the figure indicates 5 to 6 times.

The species is compared by Fowler with *Noemacheilus semi-cincta* (Blyth), probably cited in error for *N. cincticauda* (Blyth). That species, from Lower Burma, has the lateral line incomplete (ending anteriorly at the tip of the depressed pectoral), while in *N. sexcauda* the lateral line is complete; furthermore the lips are crenulated, while in *N. sexcauda* they are entire. There are marked differences also in the shape and position of the transverse bands.

NOEMACHEILUS OBSCURUS, new species

Figure 68

Description.—Body moderately compressed posteriorly, cylindrical anteriorly; depth 5.6 in standard length; caudal peduncle short, its depth equal to its length, 1.7 in head; head rather strongly depressed, 4.3 in standard length, its width slightly less than its length, its depth at nape 1.7 in head; snout broad, evenly rounded, its length 2.5 in head; eye small in anterior half of head, directed more upward than laterally, its length nearly 8 in head, 3 in snout, and 2.5 in the flat interorbital space; nasal flap short, not reaching halfway to eye; mouth lunate, wide, distance between corners of mouth 2.5 in head; lips full, fleshy, median part of upper lip projecting so as to cover a chisellike projection of the middle of the upper jaw; barbels rather short, outer rostral barbel slightly the longer and reaching vertical from middle of eye, maxillary barbel equal to outer rostral, extending well behind eye, its length 2 times diameter of eye; no gill rakers.

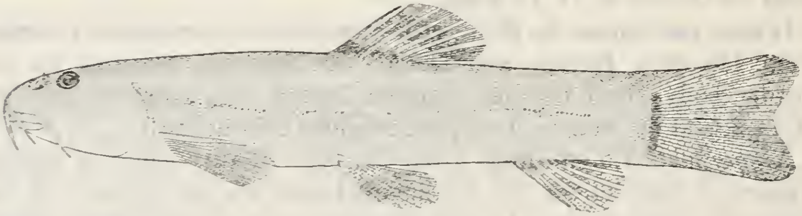


Figure 68.—*Noemacheilus obscurus*, new species: Type (M.C.Z. No. 35520). Drawn by Mrs. Aime M. Awl.

Squamation: Lateral line complete; scales minute, embedded, deficient on under surface of body, most distinct and largest on caudal peduncle.

Fins: Origin of dorsal fin midway between tip of snout and base of caudal fin, rays ii, 8, first branched ray 1.7 in head; caudal fin slightly emarginate, somewhat shorter than head; anal rays ii, 5, first branched ray a little more than 0.5 head; ventral rays i, 6, broad, rounded, barely reaching anal opening, 1.4 in head; pectoral rays i, 9, reaching 1.6 distance to ventrals, 1.25 in head.

Coloration: General color of back, sides, and head dull brown, lighter on underside of head and body; body with 13 obscure dark brown cross bands, slightly wider than interspaces, scarcely distinguishable from the color of the back and side, 5 predorsal, 3 subdorsal, 6 postdorsal, together with a narrow black band at base of caudal fin; dorsal rays dark green, interradial membranes pale yellow, a blackish spot at base of anterior rays separated by a round yellowish spot from the dark green area along the length of the dorsal base; caudal, anal, and pectoral rays dark green, membranes pale; ventrals with an indistinct dark green median band involving the rays.

Type and paratypes.—The type, 7.9 cm. long, taken by the Harvard Primate Expedition on Doi Angka, Northern Thailand, in April 1937 is at the Museum of Comparative Zoology. Paratype (U.S.N.M. No. 118439) is 7.1 cm. long.

Remarks.—This species belongs in the local group composed of *N. reidi*, *sexcauda*, *waltoni*, and *schultzi*, characterized by 10 to 18 dark cross bands, complete lateral line, and short nasal tentacle. There are no outstanding color marks except on the dorsal fin. The cross bands are hardly discernible. Other characters that, in combination, seem to distinguish the fish from related forms are the very broad, short head; obtusely rounded snout; short barbels; projecting median part of the upper lip covering a beaklike extension of the median part of the upper jaw; and very short caudal peduncle with a strong carination on the upper edge formed by the backward extension of the caudal fulcra. While the median beaklike process of the upper jaw is found in other noemacheilids, this feature is unusually prominent in the present species.

NOEMACHEILUS WALTONI Fowler

Nemacheilus waltoni Fowler, 1937, p. 157, figs. 77–79 (Mepoon).

This species is known from 3 specimens 10.2, 4.5, and 2.6 cm. long. The 13 dark cross bands in the type (5 predorsal, 3 subdorsal, 5 postdorsal) are peculiar in having narrow darker edges (possibly owing to change in preservation). The smallest specimen (Fowler's fig. 79) cannot with certainty be regarded as conspecific, as the cross bands differ materially from the type in number, position, and color.

NOEMACHEILUS SCHULTZI, new species

Figure 69

Nemacheilus rivulicola (non Hora) Fowler, 1934a, p. 107, fig. 58 (Chiengmai, Chiengdao, Metang, Huey Meka).

Description.—Form rather slender; body compressed posteriorly, cylindrical between dorsal fin and head; greatest depth of body 5.6 in standard length; least depth of caudal peduncle equal to its length and 1.7 in head; head moderately depressed, under surface flattened, its length 4.2 in standard length, its depth behind eyes 1.5 in its length, its width 1.4 in its length; eye nearly midway in length of head, its upper margin touching dorsal profile, its diameter 7 in head, 2.7 in snout, and 2.3 in the flat interorbital space; snout broad, evenly rounded, 2.4 in head; cheeks prominent; nasal flap triangular, with filamentous tip, not reaching eye; mouth moderately curved, its width equal to interorbital space, lips thick, lower lip with a median incision, which extends almost completely through lip; inner rostral barbels reaching to nostrils, outer rostral barbels longer and extending beyond anterior margin of eye, maxillary barbels still longer, about 0.5 head.

Squamation: Scales minute, completely covering body; lateral line nearly straight, continuous but less marked posteriorly.

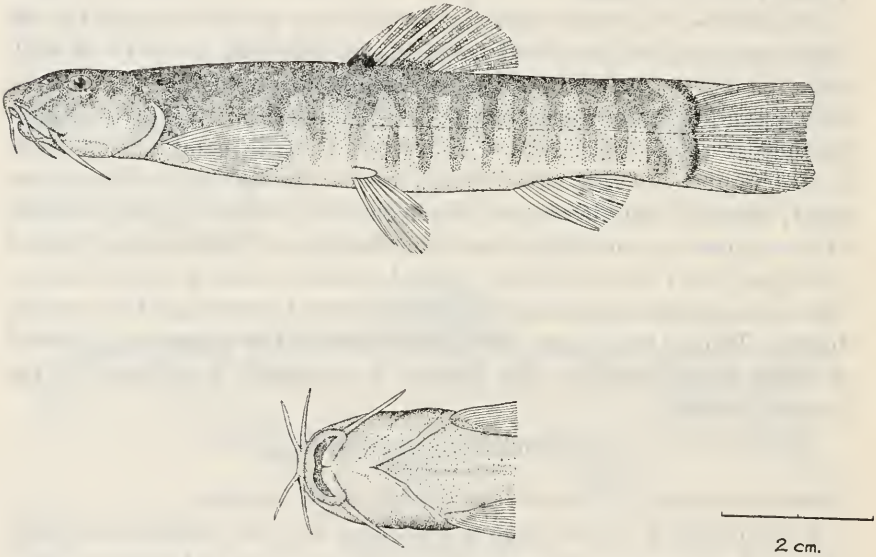


Figure 69.—*Noemacheilus schultzi,* new species: Type (U.S.N.M. No. 107953). Drawn by Miss Jane Roller.

Fins: Origin of dorsal fin over origin of ventrals, midway between tip of snout and base of caudal fin; dorsal rays iii, 8, the longest branched ray 1.8 in head; caudal fin broadly emarginate, 1.4 in head; anal rays ii, 5, the longest branched ray 0.5 length of head; ventrals 1.6 in head, a small blunt axillary scale; pectorals 1.3 in head, a short axillary process, the rays i,11, distance between pectorals at base of first rays equal to length of head minus snout.

Coloration: Back and sides pale olivaceous, upper part of head obscurely mottled; underparts pale creamy yellow; dorsal surface of outer rostral barbel olivaceous; back and sides of body with about 15 narrow black cross bands, of approximate width of interspaces, which meet over the back and extend downward to the level of the pectoral and ventral bases, the bands most regular in shape and position in posterior half of body, five of the bands predorsal, three subdorsal, seven postdorsal, together with a very black one at the base of the caudal fin; dorsal fin with a jet-black spot at its base anteriorly and another such spot along its midbase, these spots in a rich creamy yellow area, which extends the whole length of the fin, the rays distally bluish black, the membranes whitish; caudal fin pale yellow, with 2 indistinct dark cross bands, its base with a narrow, jet-black band; anal and ventral fins pale yellow; pectoral membranes bluish, rays yellow.

Type and paratypes.—The type, a male (U.S.N.M. No. 107953), 10.8 cm. long, was taken September 1, 1934, in Huey Melao, a mountain stream on Doi Hua Mot, Northern Thailand. From the same stream are 3 specimens 9.7 to 11.1 cm. long, together with 22 immature individuals 3.7 to 6.9 cm. long, taken August 14, 1934, 3 specimens 9.5, 10.2, and 10.2 cm. long, 1 of them a ripe female, together with 5 immature 4.5 to 5.3 cm., taken August 18, 1934; and 11 specimens 3.7 to 11.6 cm. long, taken August 23, 1934. Paratypes bear the following numbers: U.S.N.M. Nos. 109715, 109733, 109734, and 109754.

Remarks.—This is a large well-marked species living in mountain streams of Northern Thailand. The coloration of the body is somewhat variable. The shape of the cross bands, while fairly constant on the posterior part of the body, shows a tendency to become irregular anteriorly. The number of bands may reach 17 or 18, but is usually only 15. The black spots at the base of the dorsal fin and the narrow band at the base of the caudal do not vary.

This species falls in the group of Asiatic *Noemacheilus* characterized by a more or less complete lateral line and numerous dark cross bands on body, together with a nontubular anterior nostril and the absence of a black ocellus at the upper base of the caudal fin. Among the related forms recorded from Siam and Burma *N. sikmaiensis* Hora and *N. rivulicola* Hora seem closest. The former is a small species not exceeding 5 cm. in length, with short barbels, well-forked caudal fin, lateral line ending over middle of anal fin, and 12 or 13 regular black cross bands separated by narrower white spaces.

This appears to be the species that Fowler (1934a) identified as *Noemacheilus rivulicola* Hora from numerous specimens 3 to 9.7 cm. long from Chiengmai, Chiengdao, Metang, and Huey Meka, in Northern Thailand, judged from the figure of a fish about 7 cm. long published in the paper cited. The differences between that figure and Hora's (1929a, p. 324, pl. 15, figs. 3, 4) description and figures seem too great to be accounted for by age or individual variation. The differences are in fact of cardinal importance as specific criteria in this genus, and include the position of the dorsal fin (its origin far in advance of the midlength of body in *rivulicola*, equidistant between tip of snout and base of caudal in Fowler's figure, and well in advance of the origin of the ventral fin in *rivulicola* while opposite the origin of the ventral fin in Fowler's figure), the length of the pectoral fin (as long as head as against shorter than head), the shape of caudal fin (deeply incised as against slightly emarginate), the shape of caudal peduncle (longer than deep as against as long as deep), the lateral line (absent or rudimentary posterior to midbase of anal fin as against complete throughout), and various other features. Dr. Hora, in a letter, confirms the view herein expressed that *Noemacheilus rivulicola* of Fowler is not the *rivulicola* of Hora from the Southern Shan States of Burma.

It is a pleasure to name this fish after Dr. Leonard P. Schultz, curator of fishes in the U. S. National Museum.

NOEMACHEILUS DEIGNANI, new species

FIGURE 70

Description.—Body moderately compressed posteriorly, very slightly compressed anteriorly to dorsal fin; dorsal profile rising gradually from snout to a point a little before dorsal fin; ventral surface of head and body flattened; greatest depth of body 4¾ times in standard length; least depth of caudal peduncle 1.2 in its length and 1.7 times in head; head 4.5 in standard length, its length exceeding depth of body, very slightly depressed, its depth at nape 0.8 its width, its width 1.5 in its length; eye in anterior half of head, 7 in head, nearly 3.5 in snout, and 3.0 in flat interorbital space; lips papillose, lower lip with a deep median incision; margin of upper jaw with a rounded central horny beak, which fits into a deep emargination in the lower jaw; internarial tentacle well-developed, its length 1.5 times eye, when folded back reaching front of pupil; inner rostral barbel reaching eye, outer rostral barbel extending behind eye and longer than maxillary barbel which is 0.5 head; body fully scaled, lateral line complete.

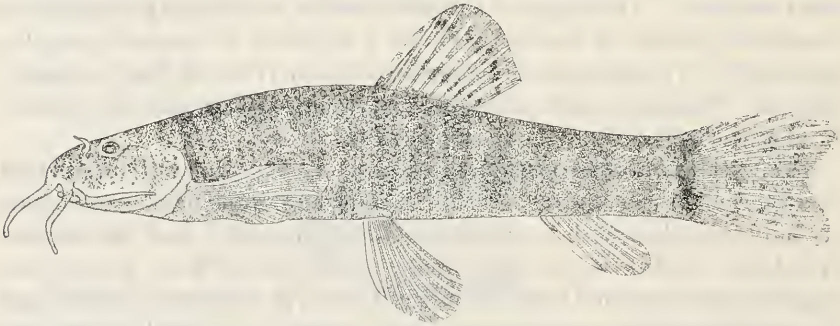


FIGURE 70.—*Noemacheilus deignani*, new species: Type (U.S.N.M. No. 107946). Drawn by Mrs. Alice C. Mullen.

Fins: Dorsal fin originating over base of ventrals, a little closer to base of caudal than tip of snout; dorsal rays iii,8, longest ray equal to depth of body; caudal longer than head, moderately incised, lobes rounded; anal rays ii,5, longest branched ray less than longest dorsal ray; pectoral fin shorter than head, longer than ventrals, its rays i,10.

Coloration: Pale, creamy yellow background of head and body largely covered with dark brown; on top of head brown areas narrowly separated by ground color have geometrical design suggestive of cephalic plates of ophicephalid fishes; sides of head brown, the color extending lowest on opercles; nasal flap colorless; outer rostral barbels brown dorsally, other barbels pale; body from head to base of caudal fin with about 14 vertical brown bands, which meet over the back but do not extend on ventral surface, the bands two or three times as wide as the interspaces; six of the bands predorsal, three subdorsal, 5 postdorsal; a narrow black stripe on the first cross band extending on base of pectoral fin; dorsal fin with a black spot at its base anteriorly and with several irregular transverse rows of black-brown spots on the rays; caudal fin with its rays marked by numerous black-brown spots having a tendency to form irregular wavy cross lines, base of fin with a conspicuous black transverse band; other fins plain.

Type and paratypes.—The type (U.S.N.M. No. 107946) is 5.3 cm. long and was collected by H. G. Deignan in a mountain brook on Kao Sabap, near Chantabun, Southeastern Thailand, April 29, 1937. From the same brook and on the same date 14 other specimens were taken, 2.9 to 4.6 cm. long (paratypes U.S.N.M. No. 107943). These agree with the type except for slight differences in pattern of coloration owing to age and individual variation. In general the cross bands are separated by slightly wider interspaces, and on the back the dark bands are constricted, leaving wider pale spaces.

Remarks.—The outstanding features of this species are the moderately elongate form, long barbels, long nasal tentacle, complete lateral line, origin of the dorsal fin considerably nearer to base of caudal than to tip of snout, numerous dark cross bands closer together than in any other species of the region, definite and peculiar pattern of markings on top of head, and the black postcephalic band, which extends on the base of the pectoral fin.

The species is named for H. G. Deignan, ornithologist, in appreciation of his zeal in collecting fishes in remoter parts of Thailand for the U. S. National Museum.

NOEMACHEILUS KOHCHANGENSIS H. M. Smith

FIGURE 71

Nemacheilus kohchangensis SMITH, 1933a, p. 56, fig. 2, pl. 1, fig. 2 (Koh Chang).—KOUMANS, 1937a, p. 64 (Northern Siam).

A mountain stream on Koh Chang, in the Gulf of Siam, yielded the type specimen of this rather strongly marked species.

The fish is 7 cm. long and has 18 narrow dark cross bands, which extend to the median line of the back and are deficient on the lower part of the body; 7 of the bands are predorsal, 3 subdorsal, and 8 postdorsal, in addition to a narrow, sharply defined, vertical black stripe at the base of the caudal fin. A black bar extends from the axil of the pectoral fin to a black blotch at the beginning of the lateral line; there is a diffuse brownish area on the upper part of the opercle; the whole upper surface of the head is covered with rounded black spots; a brown stripe extends under eye to angle of mouth; the pale yellow dorsal fin has a jet-black spot at its base anteriorly and several transverse rows of dark spots on the dorsal rays; and the greenish-yellow caudal fin has five irregular transverse rows of brown spots. The barbels are long, all reaching to or beyond the eye; the eyes, invisible from below, are much nearer to tip of snout than to the gill opening; the anterior nostril is in a tube with a posterior flap, which nearly reaches eye; the lateral line terminated in advance of the anal fin.

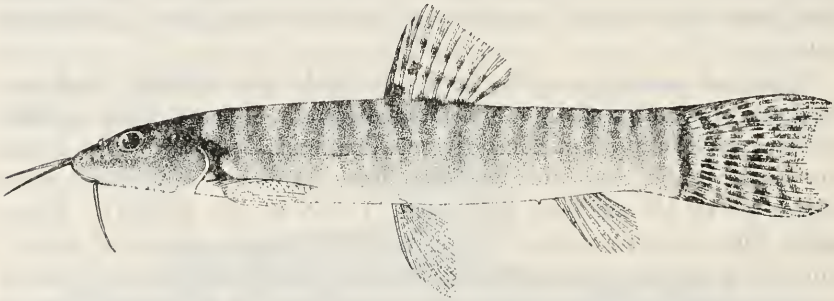


FIGURE 71.—*Noemacheilus kohchangensis* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

Koumans (1937a) reported four specimens of this fish, 8.1 to 11.1 cm. long, from a stream 580 meters above sea level on the road from Prae to Nan in Northern Thailand.

NOEMACHEILUS MULTIFASCIATUS Day

Nemacheilus multifasciatus DAY, 1878, vol. 2, pp. 613, 617, pl. 153, fig. 7 (Darjeeling and Assam, India).—VINCIGUERRA, 1889–90, p. 337 (Meekalan and Thagata Juva, Burma).

Nemachilus multifasciatus HORA and MUKERJI, 1934, p. 135 (Northern Siam).—MUKERJI, 1934, p. 43 (Northern Siam).

The status of this species as a Thai fish is somewhat uncertain. Described by Day (1878) from Darjeeling and Assam, India, the species was lost sight of until Vinciguerra reported it from Burma near the Thai border in 1890.

In a mountain brook at Pang Meton, on Doi Nangka, Northern Thailand, 20 specimens, 4.3 to 8.4 cm. long, were collected April 28, 1931.

In 1932 several specimens were received by the Siamese Bureau of Fisheries from the Mesort, in Western Thailand, this stream being a tributary of the Memue (which flows into the Salwin) and is not remote from the source of Vinciguerra's material. Some of the Thai specimens were sent to Dr. Hora, of the Indian Museum in Calcutta, and were found by him and Dev Dev Mukerji to agree with a specimen from Burma sent by Vinciguerra; but both the Burmese and the Thai forms were seen to differ from the incomplete description of Day. The opinion of the Indian ichthyologists is that the Burmese and Thai fish may bear the name *N. multifasciatus* pending the examination of typical Indian material adequate to establish the range of variation, with the possibility that the Burmo-Siamese form may prove to be entitled to specific rank.

This is a medium-sized fish, the maximum reported length being about 8.5 cm. The barbels are short, the maxillary pair being but little longer than the diameter of the eye, the rostral pairs even shorter. The lateral line is complete. The dorsal fin, with eight branched rays, has its origin above or slightly in advance of ventrals and midway between the tip of snout and the base of caudal fin. The caudal fin, equal to or slightly longer than the head, is moderately incised, with rounded lobes. The body is marked by numerous dark cross bands, which are wider and about 5 in number, posterior to the dorsal fin and very narrow, close together, and about 18 in number between the head and the posterior end of the dorsal base. A narrow black transverse bar is at the base of the caudal fin. The dorsal and caudal fins may have four or more lines of dark spots, and the anal and ventral fins may have two dark bands.

A female, 7 cm. long, from Pang Meton, with markings much less distinct than in specimens which appear to be males, contains eggs about 1.5 mm. in diameter.

NOEMACHEILUS POCULI, new species

FIGURE 72

Description.—Very elongate, body very slightly compressed anteriorly, more so in posterior half; greatest depth of body 6 times in standard length; caudal peduncle rather short, its least depth 1.6 in its length and 2 in head; a slight concavity at nape; head moderately depressed, its length 4.8 in standard length, 1.5 times its width, 1.7 times its depth; snout gently decurved, rounded, its length 2.5 in head; eye in anterior half of head, 5 in head, 2 in snout, and 1.5 in interorbital space; mouth small, lunate, surrounded by fleshy lips, the lower lip interrupted medianly, leaving exposed the sharp edge of the lower jaw; barbels short, but exceeding the diameter of the eye.

Squamation: Lateral line distinct and complete; body covered with minute scales except region between mouth and ventral fins, which is naked, about 25 rows of scales between midline of back before dorsal fin and lateral line, about 20 rows of scales between lateral line and base of ventral fins.

Fins: Origin of dorsal fin midway between anterior edge of eye and base of midcaudal rays, directly over origin of ventral fins, rays iii, 8, longest ray 0.6 head; caudal fin as long as head, forked for 0.25 its length, lobes pointed; anal rays ii,5, longest 0.7 head; ventrals 0.8 head, rays i,6; pectorals slightly larger than ventrals, rays i,10.

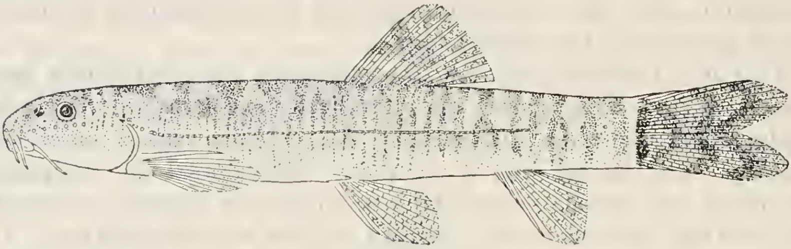


Figure 72.—*Noemacheilus poculi*, new species: Type (M.C.Z. No. 35525). Drawn by Mrs. Aime M. Awl.

Coloration: Back and sides pale yellowish green, underparts whitish or creamy; side from head to base of caudal fin marked by numerous narrow, irregular blackish or dark brown cross bands, those anterior to and under the dorsal fin about 25 in number and narrower than the posterior ones, which number about nine, extend to or nearly to median line below and meet across the back; predorsal region with about six dark brown transverse saddles; top and sides of head obscurely marbled with blackish; on the base of caudal fin, and separated from last peduncular cross band by a bright yellow area, a crescentic or lunate jet-black bar curved forward, its ends not reaching the dorsal and ventral profiles; near upper end of this bar a black saddlelike spot involving the caudal fulcra; dorsal fin with a row of black basal spots on both rays and membranes, and a black median band involving only the rays; caudal fin with three wavy dark cross bands, the posterior edge of the fin narrowly margined with dark; other fins plain.

Type and other specimens.—The type, a male 5.8 cm. long, taken in April 1937 by the Harvard Primate Expedition on Doi Angka, Northern Thailand, is in the Museum of Comparative Zoology. In the same lot are 44 other paratypes, 3 to 7.1 cm. long. (Paratypes, U.S.N.M. Nos. 118440, 118441).

Remarks.—This species most closely resembles *N. multifasciatus* Day (q. v.), showing the same peculiarity of the dark cross bands, which are extremely narrow and crowded on the anterior half of the body, wider and more widely spaced posteriorly. In the present species, however, the cross bands are much more numerous and are supplemented by dark saddles, which constitute a series of marks distinct from the cross bands. The final cross band, which is jet black, extends vertically completely across the peduncle according to Day's figure of *N. multifasciatus*, but in the present species is crescentic, does not reach the upper and lower profiles, and is supplemented superiorly by a black saddlelike spot on the fulcral caudal rays. Whereas in *N. multifasciatus* the origin of the dorsal fin is definitely in advance of the ventrals and midway between the tip of the snout and the base of the median caudal rays, in the present form the dorsal arises directly over the origin of the ventrals and is nearer to the base of the caudal by the length of the snout.

Many of the specimens are ovigerous females approaching the spawning condition; these range in size from 5.7 to 7.1 cm. and average 6.2 cm., and have the markings less distinct than in the males, which average somewhat smaller.

The specific name (from *poculum*, a bowl) is given in allusion to the mountain on which the specimens were collected, Angka meaning crow's bowl.

NOEMACHEILUS MASYAE H. M. Smith

FIGURE 73

Nemacheilus masyae SMITH, 1933a, p. 58, fig. 3, pl. 1, fig. 3 (Nakon Sritamarat, Ronpibun, Kao Sabap, Chantabun).—FOWLER, 1934a, p. 108 (Chiengmai); 1935a, p. 106 (Khao Nam Poo); 1937, p. 158 (Mepoon).

This is one of the most widely distributed of the Thailand noemacheilids. The type came from the upper waters of the Tadi rivulet, which flows from the high mountains of the Thailand-Burmese boundary, through the town of Nakon Sritamarat, into the Gulf of Siam. Other specimens from Peninsular Thailand were from a stream and a pond in Ronpibun, Province of Nakon Sritamarat. In Southeastern Thailand the fish was collected in a ditch near the town of Chantabun and in a mountain stream on Kao Sabap. More recently specimens have been obtained by Fowler from the Central region at Khao Nam Poo and Mepoon, and in the Northern area at Chiengmai. Deignan, collecting for the U. S. National Museum, got five specimens, 5 to 6 cm. long, from Huey Aw, a clear brook tributary of the Menam Nan, Northern district, April 21, 1936, two of these specimens having a preorbital hook; and three specimens, 5.9, 6.2, and 6.5 cm. long, from

Huey Lom, another tributary of the Menam Nan, June 1 to 3, 1936, of which the two smallest have a preorbital hook and are males, while the largest has no hook and is a female with nearly ripe eggs.

This is a very distinct species, at once recognizable by its slender form, long barbels, cartilaginous hook in the male extending backward from the preorbital, high dorsal fin, strongly forked caudal fin with pointed lobes, of which the upper is much longer, and peculiar pattern of coloration: a series of 14 to 20 dark brown saddles extending from back downward toward lateral line, the same number of dark brown spots along lateral line, and a small, round jet-black spot at base of caudal rays surrounded by a pale yellow area. The long barbels, preorbital hook, and deeply forked caudal fin induced Fowler (1937) to establish the subgenus *Pogononemacheilus* for this species.

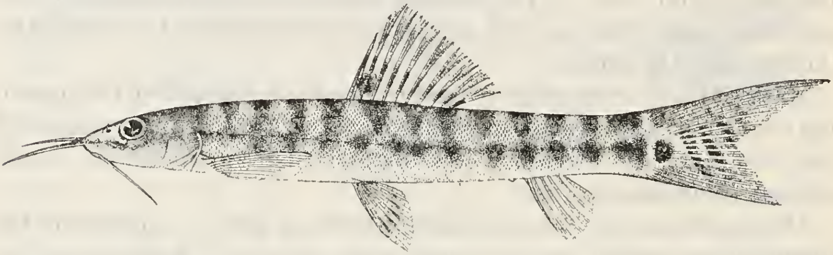


FIGURE 73.—*Noemacheilus masyae* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

The type (U.S.N.M. No. 107954) is 6.8 cm. long and is a male with preorbital hook. The largest known specimen is a female, 8 cm. long, with well-developed ova, from a waterfall stream near Chantabun. The National Museum collection contains paratypes (U.S.N.M. Nos. 109720, 109753).

NOEMACHEILUS TRANSLINEATUS Fowler

Nemacheilus trans-lineatus FOWLER, 1939, p. 63, fig. 13 (Trang).

This species is described from three specimens, 6.8, 6.5, and 6.1 cm. long, from a waterfall stream near Trang, and is peculiar in having the general color brown, with light cross bands. The deeply forked caudal fin, with pointed lobes, is another outstanding feature.

NOEMACHEILUS BUCCULENTUS, new species

FIGURE 74

Description.—Elongate, body moderately compressed posteriorly to origin of dorsal fin, depressed anteriorly; dorsal profile from head to caudal fin curved very slightly upward to and downward from dorsal fin, ventral profile straight and flat; depth 5.2 in standard length; cau-

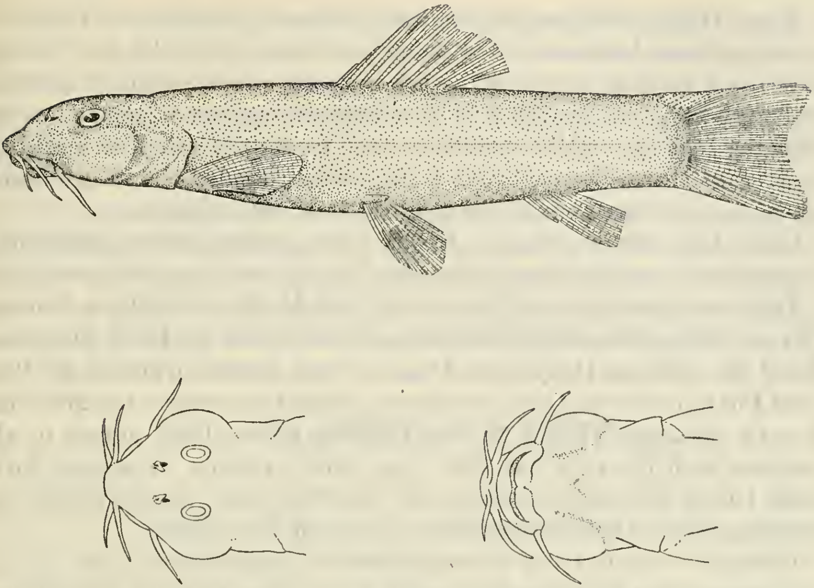


Figure 74.—*Noemacheilus bucculentus*, new species: Type (U. S. N. M. No. 107942). Drawn by Miss Jane Roller.

dal peduncle slightly longer than deep, its length 2 in head; head much depressed, 3.8 in standard length, its depth 2.3 in its length and 1.8 in its greatest breadth behind eyes; breadth of head equal to its length along median dorsal line; cheeks greatly swollen; dorsal profile of head nearly straight from nape to a prominence over nostrils, when the profile is decurved to tip of snout; snout viewed from above pointed, viewed from side slightly pug-nosed; length of snout 2.6 times in head; eyes small, dorsolateral in midlength of head, about 5 in head, 2.9 in snout, and 1.25 in interorbital space; nostrils very close together and much nearer to eye than to tip of snout, posterior nostril distant from eye somewhat more than 0.5 diameter of eye, anterior nostril in a short tube formed by the nasal tentacle, which is small, and when depressed reaches very slightly beyond posterior nostril; mouth strongly arched, its width 0.8 length of snout; lips rather thick, lower lip with a slight median incision; upper jaw with a broad beaklike process fitting against an emargination and incision in lower jaw; inner rostral barbels short, extending about halfway to nostrils; outer rostral barbels longer, extending to nostrils; maxillary barbels longer than outer rostral and when folded back reaching a point under posterior margin of orbit; opercular flap well developed; ventral ends of branchial openings separated by a space equal to length of snout; gill rakers 2+10, wide-spaced, 0.2 length of gill filaments; scales deficient on anterior half of body; lateral line nearly straight, complete.

Fins: Origin of dorsal fin slightly in advance of origin of ventrals, about midway between tip of snout and base of caudal fin; dorsal rays iii, 8, longest branched ray 1.8 in head; caudal slightly incised, its length 1.4 in head; anal rays iii, 5, longest less than 0.5 head, nearly reaching base of caudal; ventrals as long as dorsal, not quite reaching ventral aperture; pectoral rays i, 10, the fin rounded, 1.6 in head and extending 0.6 distance between pectoral and ventral bases.

Coloration: Entire head and body pale greenish brown, somewhat lighter below; no markings; fins plain, the dorsal rays dark greenish.

Type and paratypes.—The type (U.S.N.M. No. 107942), a female, 12.1 cm. long, with well-developed eggs, was taken by H. G. Deignan, April 26, 1936, in Huey Nam Puat, a clear mountain brook, at Ben Nam Puat, in French Laos; the stream ultimately reaches the Mekong. A male paratype (U.S.N.M. No. 107896), 12 cm. long, agrees in all respects with the type but with very faint evidence of several dark cross bands posterior to origin of anal fin, these marks visible on only one side. Another paratype is U.S.N.M. No. 107945.

Remarks.—Aside from its comparatively large size and pale color, this species may be recognized easily by its very full and protruding cheeks and its acutely pointed snout.

The vestiges of transverse bands observable on the male specimen suggest that the young may be marked with distinct cross bands, which become obsolete or disappear entirely in the larger adults.

NOEMACHEILUS BINOTATUS H. M. Smith

FIGURE 75

Nemacheilus binotatus SMITH, 1933a, p. 61, pl. 1, fig. 4 (Mekhan).—FOWLER, 1934a, p. 104 (Chiengmai).

This species is known only from the Meping and tributaries in Northern Thailand. The type and cotype, 5.2 and 4.5 cm. long, were collected in the Mekhan, a picturesque mountain stream, at a point where it lies southwest of Chiengmai. Fowler had numerous specimens, 1.4 to 3.8 cm. long, from the Meping at Chiengmai.

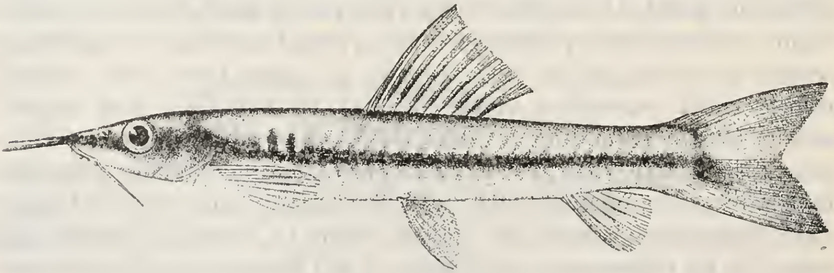


FIGURE 75.—*Noemacheilus binotatus* H. M. Smith. Drawn by Luang Masya; courtesy of the Thailand Government.

The fish is unique among the Thailand representatives of the genus *Noemacheilus* in having no cross bands on body but is characteristically marked with a narrow sharply defined black stripe extending from head to base of caudal fin; from the stripe, above the middle of the pectoral fin when depressed, two short black bars extend vertically about halfway to the median line of the back, the bars occupying a bright yellow area, and there is a round black spot on the base of the central rays of the caudal fin. A black area extends from gill opening to eye and is continued as a well-defined stripe from eye to tip of snout and thence to dorsal surface of the four rostral barbels. The body is slender, the head is long, the dorsal fin is high, the caudal fin is broad and moderately forked, and the lower fins are comparatively small.

Order NEMATOGNATHI: Catfishes

The catfishes are very numerously represented in Thailand. They fall into 10 families, 34 genera, and about a hundred species, ranging in size from 5 centimeters to 3 meters.[5]

The great majority of the species live only in fresh water. The few that are strictly marine have fresh-water relatives and are herein referred to in order to make the family and generic treatments complete.

In the adaptation of the local catfishes to the peculiar physical conditions that have to be overcome, some remarkable habits and structural features have developed. Thus, in one large family (Tachysuridae) most of the members practice oral incubation, and in another family (Clariidae) all the members have special air-breathing apparatus to supplement the gills. In some mountain-stream catfishes (family Sisoridae) there is a thoracic adhesive organ to aid in maintaining themselves in swift water.

The catfishes are important as food, especially for the people of interior districts. Every species, regardless of size, is eaten.

The families of this order may be differentiated as follows:

1*a*. Dorsal fin absent or, if present, spineless; no adipose fin.
  2*a*. Dorsal fin few rayed, rudimentary, or absent.
    3*a*. Two pairs of barbels (maxillary and mandibulary); breathing apparatus of ordinary type -- Siluridae
    3*b*. Four pairs of barbels (nasal, maxillary, mandibulary, and mental); breathing apparatus highly modified, a pair of cylindrical air sacs extending from gill cavity through muscles of back to tail. Heteropneustidae

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[5] The richness of this fauna may be better appreciated when it is stated that continental United States, with fifteen times the area of Thailand, has in its fresh and coastal waters only one-third the number of catfish species. India and Burma, with nine times the area of Thailand, have about the same number of catfish genera and only about 12 percent more species.

2*b*. Dorsal fin many rayed, extending nearly entire length of back; 4 pairs of barbels; a supplementary arborescent breathing organ in upper part of each gill cavity-- **Clariidae**

1*b*. Dorsal fin few rayed, with pungent spine.
  4*a*. No adipose dorsal fin; caudal fin confluent with the long anal fin and extending forward as a second dorsal fin------------------ **Plotosidae**
  4*b*. Adipose fin present; caudal fin forked, emarginate, or truncate.
    5*a*. Anal fin long, with 28 to 40 rays; adipose dorsal fin small; gill-membranes free from isthmus-- **Schilbeidae**
    5*b*. Anal fin mostly short, with 8 to 22 rays; adipose dorsal fin well developed.
      6*a*. Gill membranes united to each other, free from isthmus.
        7*a*. Nostrils close together; dorsal and pectoral spines weak. **Amblycipitidae**
        7*b*. Nostrils widely separated; dorsal and pectoral spines strong. **Bagridae**
      6*b*. Gill membranes united to isthmus.
        8*a*. Nostrils close together, separated by a barbel------------ **Sisoridae**
        8*b*. Nostrils close together, separate by a valve---------- **Tachysuridae**
        8*c*. Nostrils well separated, the posterior with a barbel------ **Akysidae**

Family SILURIDAE

This family includes more genera than does any other family of Thai catfishes, although the number of species is less than in the Tachysuridae.

The local members of the family are easily recognizable by 2 pairs of barbels (maxillary and mandibulary, the latter often very feebly developed), very small or altogether deficient dorsal fin (which has no spine), deficient adipose fin, extremely long anal fin (with 50 to 105 rays), and a weak or moderately strong pectoral spine with or without denticulations.

Recent revisions of the nomenclature have made necessary a number of changes in long-established generic names in order to conform to modern rules. The following genera are here recognized:

1*a*. Eyes with a free fold of skin, above level of angle of mouth; vomerine teeth in 2 separate patches or in a more or less continuous band; dorsal fin with 4 or 5 rays; ventral rays 9 to 11.
  2*a*. Vomerine teeth always in 2 well-separated elongate patches; dorsal fin with 5 rays; caudal fin forked and entirely free from anal fin. **Wallagonia**
  2*b*. Vomerine teeth in a transverse band, which may be either continuous or medianly separated or constricted; dorsal fin with 4 rays; caudal fin rounded and united to anal fin---------------------------- **Parasilurus**

1*b*. Eyes subcutaneous, above or behind level of angle of mouth.
  3*a*. Dorsal fin with 3 to 5 rays.
    4*a*. Caudal fin unequally lobed or obliquely emarginate or truncate, broadly united to anal fin; eye above angle of mouth; teeth on vomer in a single rounded patch; ventral rays 7------------------ **Silurichthys**
    4*b*. Caudal fin deeply forked, entirely free from or very slightly connected with anal fin.

5*a*. Jaw teeth long, unequal, wide set, in several rows; teeth on vomer in a single transverse patch; eye above angle of mouth; ventral rays 9 or 10 ---------- Wallago
5*b*. Jaw teeth in a villiform band; eye behind angle of mouth; ventral rays 7 or 8.
  6*a*. Vomerine teeth in 2 transverse patches of 2 rows of teeth connected by a single row of teeth ---------- Silurodes
  6*b*. Vomerine teeth in 2 separate patches ---------- Ompok
3*b*. Dorsal fin rudimentary or absent.
  7*a*. Vomerine teeth in 2 separate patches; maxillary barbel short, hooked, bony ---------- Ceratoglanis
  7*b*. Vomerine teeth in a single transverse band; maxillary barbel filamentous ---------- Kryptopterus

Genus WALLAGONIA Myers

Wallagonia Myers, Copeia, 1938, No. 2, p. 98. (Type, *Wallago leerii* Bleeker.)

It is unfortunate that the time-honored name of *Wallago*, borne by these fishes since 1858, has had to yield to the law of priority and be reassigned to the species to which it was originally given by Bleeker in 1851. In that year, Bleeker, as was his custom in making use of colloquial names, took the Indian fish name *wallago*, gave it generic rank, and employed it in connection with a new species (*dinema*) not found in India. There was no separate description or diagnosis of the genus *Wallago*, a circumstance that led Weber and de Beaufort (1913, vol. 2) to reject the name as applied to *dinema* and to adopt it as used later by Bleeker with an entirely different connotation. The generic characters, however, were included with the specific diagnosis, as was done before and since Bleeker's day for genera that are now recognized as valid, and there seems to be little doubt that *Wallago dinema* should stand as originally set forth.

Seven years after *Wallago dinema* was established, Bleeker, with a vagarious turn such as is often associated with outstanding genius, adopted the name *Wallago* for two fishes not congeneric with the original *Wallago* and created a new generic name, *Belodontichthys*, to accommodate the species he had formerly placed in *Wallago*, but this time he called it *macrochir* and designated *dinema* as a synonym!

Dr. Sundar Lal Hora of the Indian Museum in Calcutta (1936a) discussed this nomenclatorial question in its varied aspects and retained the name *Wallago* in its secondary application in the hope that, the matter having been referred to the International Commission on Zoological Nomenclature, the names *Wallago* and *Belodontichthys* in their more recent signification may be included among the *nomina conservanda*. Dr. Hora recognizes, however, that under a strict interpretation of the accepted rules the name *Wallago* is not available for the fishes later so called.

The action to provide a generic name for the fishes that had been called *Wallago* was taken by Myers (1938) in proposing the new genus *Wallagonia*, with *W. leerii* as the genotype.

Two species of *Wallagonia* from Thailand are recognized herein, as follows:

1*a*. Mouth extending far posterior to eye; gill rakers 21; anal rays 86 to 93 ---------- attu

1*b*. Mouth extending to vertical from front of eyes; gill rakers 9; anal rays 64 to 72 ---------- miostoma

WALLAGONIA ATTU (Bloch)

Silurus attu Bloch, *in* Schneider, 1801, p 378, pl. 75 (Malabar).

Wallago attu Bleeker, 1865, (356), p. 175 (Siam).—Sauvage, 1883b, p. 154 (Menam Chao Phya).—Weber and de Beaufort, 1913, vol. 2, p. 201 (Siam).—Hora, 1923b, p. 165 (Bangkok).—Vipulya, p. 225 (Bangkok).—Fowler, 1934a, p. 87 (Chiengmai, Chiengsen); 1939, p. 43 (Krabi).

The range of this striking species covers Java, Sumatra, Ceylon, India, Burma, Thailand, and Indochina. In Thailand it is found in the larger streams. Specimens have been obtained from the Menam Chao Phya at various points between Bangkok and Paknampo, from the Menam Nan near its mouth, and from the Mekok at Chiengrai. Fowler records the species from the Meping at Chiengmai and the Mekong at Chiengsen.

It is one of the largest, most powerful, and most predatory of the local catfishes. A length of nearly 2 meters is attained. Some examples examined by the writer have been over a meter long, and many up to 60 to 75 cm. long have been seen in the fishermen's boats and in the markets of the river towns.

The presence of the fish in a given place is usually made known by its pursuit of small fishes at or near the surface and by its habit, at such times, of jumping entirely out of the water and falling back with a loud splash. When small cyprinoids known as a *pla soi* are running upstream in their annual migration, the *pla khao* (as this fish is always known to the Thai) remain with the schools and gorge themselves. Their great size, large mouth, and formidable teeth enable them to kill and devour almost every kind of fish.

WALLAGONIA MIOSTOMA (Vaillant)

Wallago miostoma Vaillant, 1902, p. 44 (Tepoe, Borneo).—Smith, 1933a, p. 75 (Central Siam).

This large catfish had been known only in rivers of Borneo and Sumatra until it was recorded from Thailand in 1933. It is found in the larger rivers of the Central district, but it has not been common in recent years. The upper Menam Chao Phya, in the Paknampo section, seems to be its principal resort. On January 6, 1924, a specimen 75.5 cm. long was collected at Paknampo and a fish 88 cm. long was examined there. A fishery conducted with seines in the deeper parts of the river near Paknampo yielded five or six fishes daily in December and January for the local market, and examples a meter long and weighing 50 kg. have been taken there. Another fishing center is the Lopburi River, whence fish are sent to the Bangkok market during the season of high water.

This fish is well known to the fishermen, who give it names borne by no other species. One vernacular name is *pla tuk* (or *ituk* or *itok*), perhaps in allusion to its somber color. Another is *pla itub* (*itub*, to beat), possibly in reference to the splash made by the fish when it strikes the surface of the water after having leaped out in pursuit of small cyprinoids. Still another name is *pla khao dam* (*dam*, black), to distinguish it from *Wallagonia attu*, which is called *pla khao* (*khao*, white).

Genus PARASILURUS Bleeker

Parasilurus Bleeker (299), Versl. Med. Akad. Amsterdam, vol. 14, pp. 392, 394, 1862. (Type, *Silurus japonicus* Schlegel.)

PARASILURUS COCHINCHINENSIS (Cuvier and Valenciennes)

Silurus cochinchinensis Cuvier and Valenciennes, 1839, vol. 14, p. 352 (locality not given).

The inclusion of this species in the Thai fauna is based on a specimen, 22.6 cm. long, collected by Layang Gaddi on September 11, 1933, in a waterfall stream on Kao Chong, near Trang, in Peninsular Thailand. Features of this specimen are: Lower jaw slightly shorter than the upper, vomerine teeth in a continuous transverse band, maxillary barbels extending on the anal fin, mandibulary barbels reaching base of pectorals, anal rays 63, ventral rays 9, pectoral rays I, 14, anal fin united with the caudal, and lower caudal rays appreciably longer than the upper.

In the original description of this species from Cochinchina by Cuvier and Valenciennes in 1839, the vomerine teeth were stated to be divided into two groups; Day (1878, vol. 2, p. 481) gave these teeth as "in two oval spots on the vomer divided by a smooth interspace"; and Günther (1864, vol. 5, p. 34) referred to them as "forming a band, which is a little interrupted in the middle." Examples from Hainan Island, China, in the American Museum of Natural History, courteously examined by John T. Nichols, curator of recent fishes in that institution, were found by him to have the vomerine teeth either in a continuous band, as in the Thailand example, or the band with a median indentation posteriorly, but never were the teeth definitely separated into two discontinuous patches. These variations in vomerine teeth are in specimens that are in general agreement in other respects, with the exception that the pectoral rays as given by Cuvier and Valenciennes, Günther, and Day are I, 11 while in the Thai specimen they are I, 14.

This fish is given the name *pla dong* by the people of the Trang district.

Genus SILURICHTHYS Bleeker

Silurichthys Bleeker (189), Act. Soc. Sci. Indo-Neërl. (Siluri), vol. 4, p. 268, 1858. (Type, *Silurus phaiosoma* Bleeker.)

In these fishes the anal and caudal fins are completely confluent, a feature not found in any other local genus of the family. The anal fin is very long, and the ventrals and dorsal are inserted far forward. The caudal fin is normally asymmetrical, with the lobes of unequal length. A pair of long barbels arises from the side of the anterior nostril and another pair is inserted behind the chin.

The two species of *Silurichthys* ascribed to Thailand are differentiated as follows:

1*a*. Anal rays 53 to 58; dorsal fin over ventrals; caudal fin obliquely truncate or, in fully developed examples, with pointed lobes, of which the upper is much the longer ---------- phaiosoma
1*b*. Anal rays 67; dorsal fin in advance of ventrals; caudal fin rounded. leucopodus

SILURICHTHYS PHAIOSOMA (Bleeker)

Figure 76

Silurus phaiosoma Bleeker, 1851 (49), p. 428, 1851 (Sambas, Borneo).
Silurichthys phaiosoma Smith, 1933a, p. 77 (Chantabun River).—Fowler, 1934a, p. 87 (Chantabun).

This species, known from Sumatra, Borneo, Bangka, Billiton, Singapore, and Malacca, has an apparently restricted range in Thailand, where it was collected for the first time for the Siamese Bureau of Fisheries in 1927. On February 7 of that year five specimens, the largest 7 cm. long, were taken in the Chantabun River near the town

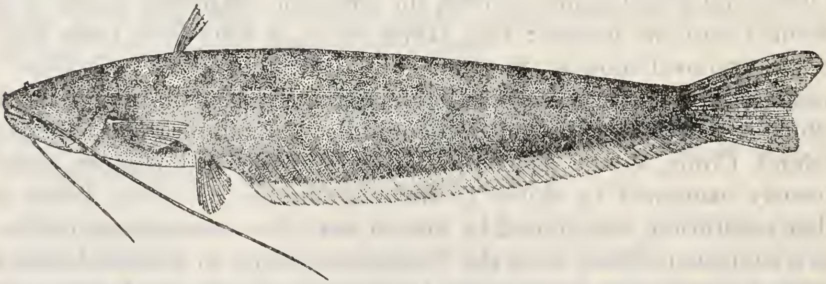


Figure 76.—*Silurichthys phaiosoma* (Bleeker). Drawn by Luang Masya courtesy of the Thailand Government.

of Chantabun. Another specimen 6.5 cm. long was taken at the same place on October 7, 1927. R. M. de Schauensee collected three specimens, 5 to 11.2 cm. long, in the same locality in April 1933, as reported by Fowler (1934a).

A length of 14 cm. is attained in the Dutch East Indies.

The fishermen of the Chantabun region apply to this fish the name *pla cha-on hin*, given to no other fish.

SILURICHTHYS LEUCOPODUS Fowler

Silurichthys leucopodus Fowler, 1939, p. 56, figs. 4–6 (waterfall at Trang).

A single specimen 15.7 cm. long was collected in 1938 in the waterfall stream on Kao Chong near Trang, in Peninsular Thailand. Fowler compared the species with *S. schneideri* Volz (1904) from Sumatra, which was described as having 64 anal rays but otherwise in agreement with *S. phaiosoma*, from which Weber and de Beaufort doubtfully separated it; the ventral fins are directly under the dorsal, as in *S. phaiosoma*, while in *S. leucopodus* the ventrals are entirely posterior to the dorsal.

The possession by this species of an evenly rounded caudal fin, as shown by Fowler's description and figure, is at variance with the generic definition given by Günther, Weber and de Beaufort, and others, and requires further consideration.

Genus WALLAGO Bleeker

Wallago Bleeker (45), Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 202, 1851. (Type, *Wallago dinema* Bleeker.)

As stated under *Wallagonia*, the generic name *Belodontichthys*, first used for this species by Bleeker in 1858 and continuously by authors from that date until 1938, is not available, being a pure synonym of *Wallago*.

WALLAGO DINEMA Bleeker

Wallago dinema Bleeker, 1851 (45), p. 202 (Borneo).

Belodontichthys macrochir Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—Peters, 1868, p. 271 (Siam).

Belodontichthys dinema Weber and de Beaufort, 1913, vol. 2, p. 204, fig. 79 (Siam).—Hora, 1923b, p. 165 (Nontaburi).—Fowler, 1935a, p. 96 (Bangkok).

The range of this species extends from Borneo and Sumatra through Malaya into Thailand. In Thailand the fish is to be found in the large rivers of the central area (Menam Chao Phya, Meklong, and other localities) and is one of the commonest of the catfishes, easily recognizable by its large, strongly upturned mouth armed with slender teeth in several rows in each jaw. It frequents the deeper parts of rivers, and is most in evidence while feeding on the migrating schools of young cyprinoid fishes (*pla soi*). During the clear-water season it may be caught with a trolling spoon.

Fish of a length of 30 to 40 cm. are common. The largest actually observed, taken in the Meklong at Ban Pong, March 11, 1931, were 70 cm. long.

Among the Thai this fish is considered to have a very good flavor and is popular. As it dies immediately after being taken from the water, its flesh deteriorates quickly.

The usual vernacular name given to the fish is *pla biew* or *pla bieo; biew* means deflected or bent, in allusion to the shape of the mouth. Another name in the Bangkok district is *pla kang buan* (projecting jaw fish).

Genus SILURODES Bleeker

Silurodes Bleeker (189), Act. Soc. Sci. Indo-Neerl. (Indischen Archipel), vol. 4, p. 271, 1858. (Type, *Silurus hypophthalmus* Bleeker.)

The only difference between *Silurodes* and *Ompok*, as indicated in the foregoing key, is in the vomerine teeth, fishes in the former genus having those teeth in a single patch, fishes in the latter genus having the teeth in two patches. This difference holds good for all Thai fishes examined, and *Silurodes* may be recognized as valid in the present connection; but, as pointed out by Hora (1936b), the union of the vomerine teeth in one patch or their separation into two patches may, in the Siluridae, represent individual variation in both genera and species.

SILURODES HYPOPHTHALMUS (Bleeker)

Silurus hypophthalmus Bleeker, 1846 (3), p. 149 (Batavia).
Silurodes hypophthalmus Smith, 1933a, p. 77 (Patani River, Tale Noi, Pasak).

This is one of numerous species of fresh-water fishes that occur in Borneo, Java, and Sumatra and extend their range to the mainland of Asia, as shown by collections made by the writer for the Siamese Bureau of Fisheries in three different localities. In the Patani River, Peninsular Thailand, two specimens 13 and 15 cm. long were obtained in a cast net October 15, 1923; in that section the fish has the Malay name of *ikan laeh puteh* (*puteh*, white) and reaches a length of 30 cm. In the Tale Noi, Peninsular Thailand, the fish is very common; specimens taken by seining July 6, 1929, were 14.5 and 16 cm. long and were the largest observed in that lake. By the use of a cast net in the lower Pasak River, Central region, February 26, 1925, a number of fish were caught; two that were preserved, 16.5 and 17.5 cm. long, had a very conspicuous black spot on the caudal peduncle and black membrane in the pectoral fins.

The name in use by the Pasak River fishermen is *pla nua on*.

Genus OMPOK Lacepède

Ompok LACEPÈDE, Histoire naturelle des poissons, vol. 5, p. 49, 1803. (Type, *Ompok siluroides* Lacepède.)

The generic name *Ompok*, given and defined by Lacepède in 1803, with a designated species (*siluroides*), unquestionably supplants *Callichrous* of Hamilton, 1822. Bleeker (1862 (301), vol. 2, p. 85) appears to have been largely responsible for the substitution of the later for the earlier name. This action, followed by most of the later authors, was based on the wholly untenable ground that the name "rested on an error and was only a mutilated reproduction of the Malay name *Limpok*."

Lacepède's diagnosis of *Ompok* leaves much to be desired. The specimen on which the genus was based was dried and very badly preserved; the accompanying drawing was faulty; and the description erroneously stipulated the absence of a dorsal fin, which was overlooked. More than 30 years later Valenciennes (Cuvier and Valenciennes, 1839, vol. 14, p. 362) reexamined Lacepède's type specimen and discovered the dorsal fin.

The fact that a genus is inadequately or even incorrectly described does not affect the validity of the proposed name if it otherwise conforms to the requirements of zoological nomenclature. In this case, with a single recognizable species designated and described, and with the principal defect in the original description subsequently rectified by a reexamination of the type, *Ompok* clearly leaves no room for *Callichrous* (Hamilton, 1822), which was not diagnosed or defined by Hamilton and was first defined by Swainson (1839, p. 306). In 1862 Bleeker, (1862 (301), vol. 2, p. 17) redefined *Callichrous* and designated as its type *pabda* of Hamilton, a synonym of Lacepède's *siluroides* (which in turn was equivalent to Bloch's *Silurus bimaculatus*, 1797).

OMPOK BIMACULATUS (Bloch)

FIGURE 77

Silurus bimaculatus BLOCH, 1797, vol. 11, p. 17, pl. 364 (Malabar).

Callichrous bimaculatus BLEEKER, 1865 (356), p. 175 (Siam).—PETERS, 1868, p. 271 (Siam).—WEBER and DE BEAUFORT, 1913, vol. 2, p. 209 (Siam).—HORA, 1923b, p. 165 (Nontaburi).

Ompok bimaculatus FOWLER, 1935a, p. 96 (Bangkok).

The range of this species extends from Java, Borneo, and Sumatra to Malaya, Thailand, and Indo-China, and thence to Burma, India, and Ceylon. In Thailand the fish is widely distributed and abundant in the central plain, the Peninsula, and in Southeastern and Eastern Thailand. Waters from which specimens have been examined and preserved are: Central Thailand (Menam Chao Phya at Paknam, Bangkok, Nontaburi, and Paknampo; Menam Sak at Dha Luang;

Menam Lopburi at Lopburi; Menam Chao Chet at Ban Poh; Menam Nan basin at Bung Borapet and Klong Borapet); Southeastern Thailand (Menam Chantabun at Chantabun and Kao Sabap; Klong Ban Taeng, Krat); Peninsular Thailand (Tale Sap; Tale Noi; Klong Kae Chieg at Patalung; Klong Nakon Noi at Nakon Sritamarat; Patani River at Patani); Eastern Thailand (tributaries of Menam Mun at Korat).

This fish attains a length of 40 to 45 cm., but the usual size of fish caught in Thailand does not greatly exceed 25 cm., and many only 15 to 20 cm. long are seen in the markets.

Two females, 25.5 cm. long, taken October 8, 1923, in the Tale Noi had large ovaries with nearly ripe eggs; another of similar size caught October 15, 1923, with a cast net in the Patani River at Patani also had large ovaries.

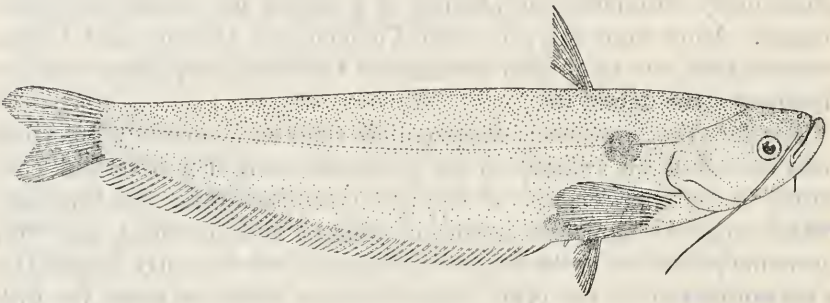


FIGURE 77.—*Ompok bimaculatus* (Bloch). Drawn by Luang Masya; courtesy of the Thailand Government.

The fish in Thailand is subject to considerable variation in body proportions, and similar characters which, in some cases, may justify recognition as races or subspecies. Specimens from Peninsular Siam and from the Pasak, Lopburi, and Chao Chet Rivers in Central Siam have been set aside tentatively as representing new forms, but final action should await more material that may indicate the range of normal variation in the species. Hora (1936b) has shown that a dozen or more nominal Indian species of *Ompok* described by Hamilton, Day, and others may be safely assigned to *bimaculatus*.

This fish bears a variety of names, some peculiar to it, some shared by related species. A common name of wide use is *pla nua on* (soft-flesh fish). Another, employed in both Peninsular Siam and Southeastern Thailand, is *pla cha oan*. In the Tale Noi this name is shortened to *pla oan* (bent fish). At Paknampo, at the head of the Menam Chao Phya, the name *pla na san* (short-snout fish) may be heard. Among Malay fishermen in the Patani Province a name in use is *ikan laeh itam*.

Genus CERATOGLANIS Myers

Ceratoglanis Myers, Copeia, No. 2, p. 98, 1938. (Type, *Hemisilurus scleronema* Bleeker.)

Myers (1938) established this genus for the accommodation of a species (*scleronema*) that for years had been carried in *Hemisilurus*. The characters separating *Ceratoglanis* from *Hemisilurus* are very short, bony, hooked maxillary barbels (as opposed to long, filamentous ones) and posterior nostrils situated before a vertical from the front of the eye (as opposed to their position in or behind a vertical from the front of the eye).

CERATOGLANIS SCLERONEMA (Bleeker)

Hemisilurus scleronema Bleeker, 1862 (301), vol. 2, p. 93 (East Indies); Smith, 1931d, p. 181 (Nakon Nayok River).

This fish was believed to be restricted to Borneo, Java, and Sumatra until a specimen was taken in the Nakon Nayok River, Central Thailand, December 25, 1929.

The specimen was 19 cm. long, but over twice that length is attained in the Dutch East Indies.

The local name of *pla saiyu* (hinge fish) was reported by the Boy Scout who collected the unique specimen.

Genus KRYPTOPTERUS Bleeker

Kryptopterus Bleeker (189), Acta Soc. Sci. Indo-Neërl. (Siluri), vol. 4, pp. 21, 255, 283, 1858. (Type, *Kryptopterus micropus* (Bleeker) =*Silurus cryptopterus* Bleeker.)

With a single exception, the members of this genus in Thailand are rather small. They are mostly inhabitants of the larger rivers, and some of them occur in great abundance and enter conspicuously into the food supply of urban and country people. The compressed body, depressed head, rudimentary or absent dorsal fin, very long anal fin, and two pairs of barbels render these fishes easily recognizable. There are eight species assignable to the local fauna, as follows:

1*a*. Dorsal fin present but rudimentary (consisting of 1 or 2 rays); ventral rays 6 or 7.
  2*a*. Maxillary barbels reaching end or posterior fourth of anal fin; mandibulary barbels longer than head; anal rays more than 70 ____________ limpok
  2*b*. Maxillary barbels not reaching beyond first fourth of anal fin; mandibulary barbels shorter than eye.
    3*a*. Maxillary barbels reaching base of pectorals; branchiostegal rays 10 or 11; anal rays 64 to 70 ______________________________ cryptopterus
    3*b*. Maxillary barbels extending to ventrals or front of anal; branchiostegal rays 8 or 9; anal rays 52 to 70 ___________________________ bicirrhis

1*b*. Dorsal fin absent; ventral rays 8 to 10.
  4*a*. Vomerine teeth in a short, straight, elliptic band; ventral rays 8.
    5*a*. Head 6.5 to 7.2 in standard length; lower jaw strongly projecting; anal rays 74 to 83; base of anal fin 4.5 times length of head; pectorals longer than head, the rays i, 16 or i, 17 ---------------------- hexapterus
    5*b*. Head 5.8 in standard length; jaws equal; anal rays 66; base of anal fin 3.5 times length of head; pectorals equal to head, the rays i, 13. moorei
  4*b*. Vomerine teeth in a curved or angular band; maxillary and mandibulary barbels always shorter than head; pectorals shorter than head; ventral rays 9 or 10.
    6*a*. Vomerine teeth in an angular band; anal rays 78 to 91; maxillary barbels reaching hind border of eye; mandibulary barbels shorter than eye, sometimes absent; base of anal fin 3.25 to 3.5 times length of head -- apogon
    6*b*. Vomerine teeth in a curved band; mandibulary barbels shorter than eye, always present.
      7*a*. Maxillary barbels reaching posterior border of eye; anal rays 86 to 93; base of anal fin 4 times length of head ---------- micronema
      7*b*. Maxillary barbels not extending beyond angle of mouth; anal rays about 80; base of anal fin 3 times length of head --------- bleekeri

KRYPTOPTERUS LIMPOK (Bleeker)

Silurus limpok Bleeker, 1852 (67), p. 583 (Palembang, Sumatra).
Kryptopterus limpok, Smith, 1933a, p. 75 (Menam Chao Phya, Menam Sak).

The Thailand records for this species, otherwise known only from Borneo and Sumatra, are for three specimens taken in the Pasak River at Dha Luang August 20, 1923, and one specimen caught with a cast net in the Chao Phya River at Bangkok September 12, 1924; the specimens are 15.5 to 19 cm. long. In one of the Pasak River specimens the maxillary barbels extend to the end of the anal fin, in the others only to the posterior fourth of that fin, which seems to be usual; in two of them the anal fin is clearly joined to the base of the caudal fin by membrane. In all other characters the Thailand material is typical.

KRYPTOPTERUS CRYPTOPTERUS (Bleeker)

Silurus cryptopterus Bleeker, 1851 (35), p. 270 (Bandjermassing, Borneo).
Cryptopterus micropus Günther, 1864, vol. 5, p. 42 (Siam).—von Martens, 1876, p. 399 (Siam).
Cryptopterus cryptopterus Weber and de Beaufort, 1913, vol. 2, p. 218 (Siam).—Hora, 1923b, p. 166 (Nontaburi).—Vipulya, 1923, p. 225 (Bangkok).
Kryptopterus cryptopterus Fowler, 1937, p. 136 (Paknam, Bangkok); 1939, p. 43 (Krabi).

The range of this species extends from Borneo and Sumatra to Malaya and Thailand. It is one of the commonest of the kryptopterid fishes in Thai waters, and it is known from the lower Chao Phya River, the Pasak River, the Bangpakong River, the Meklong River, the Tapi

River, and various other streams in the Peninsula. There are no records for Northern, Eastern, and Southeastern Thailand.

Local adult specimens have been 11 to 15.5 cm. long. The maximum length in the East Indies is 20 cm. When Prince Vipulya (1923) ascribed to this fish in the Bangkok region a weight of "anything up to 3 pounds" he must have confused it with another member of this genus. Of eight specimens taken in the Bangpakong River July 1, 1923, the largest was a female, 15 cm. long, containing ripe eggs 1 mm. in diameter.

Specimens from the Tapi River near Bandon taken September 30, 1923, were peculiar in having a black edge to the upper caudal lobe, a broad black margin on the pectorals, and a dusky anal, while of two specimens from the Pasak River August 20, 1923, one showed a conspicuous black posterior border on the pectorals and the other a strongly marked black edge on the upper part of the lower caudal lobe. The published descriptions and Bleeker's colored plate of this species give no black on any of the fins.

It is eaten extensively as fresh fish and it is also preserved for market by smoking on spits. As a food it is one of the most highly esteemed of the fresh-water fishes of Thailand.

This species shares with others of the genus the vernacular name of *pla neua on* (soft-flesh fish).

KRYPTOPTERUS BICIRRHIS (Cuvier and Valenciennes)

Silurus bicirrhis CUVIER and VALENCIENNES, 1839, vol. 14, p. 367 (Java).
Cryptopterus bicirris VON MARTENS, 1876, p. 399 (Siam).
Cryptopterus bicirrhis WEBER and DE BEAUFORT, 1913, vol. 2, p. 217 (Siam).
Kryptopterus bicirrhis FOWLER, 1935a, p. 96 (Bangkok).—FOWLER, 1937, p. 136 (Bangkok).

The centers of abundance of this species are the rivers of Java, Sumatra, and Borneo. There are only a few records for Thailand, all for the southern part of the great central plain. Further collecting will undoubtedly extend the local range, but it is much less numerous than several other members of the genus in the localities where it is already known.

It is a comparatively small species. Two specimens from the Pasek River at Dha Luang taken August 20, 1923, were 9.5 cm. long; 1 from the Nakon Nayok River, August 10, 1929, was 11.3 cm. long; and 26 from the Menam Chao Phya (as reported by Fowler) were 7.8 to 14.6 cm. long.

On the Nakon Nayok a local name for the fish is *pla krayok* (windowpane fish), in allusion to the translucent area on the side above the pectoral fin marking the position of the swim bladder.

KRYPTOPTERUS HEXAPTERUS (Bleeker)

Silurus hexapterus Bleeker, 1851 (45), p. 203 (Bandjermassing, Borneo).

Micronema hexapterus Bleeker, 1865 (356), p. 175 (Siam).—Sauvage, 1881, p. 161 (Siam); 1883b, p. 154 (Menam Chao Phya).

Cryptopterus hexapterus Weber and de Beaufort, 1913, vol. 2, p. 222 (Siam).

Kryptopterus hexapterus Fowler, 1934a, p. 87 (Chiengmai, Chiengsen, Bangkok); 1934b, p. 337 (Bangkok); 1935a, p. 98 (Bangkok); 1937, p. 137 (Bangkok); 1939, p. 43 (Krabi).

Collections made for the Siamese Bureau of Fisheries contain specimens of this species from the Menam Chao Phya at Bangkok, September 12, 1923, and the lower Bangpakong River, July 1, 1923, and June 26, 1933; these specimens were from 14.5 to 19.0 cm. long. The fish taken from the Bankpakong in 1923 had the band of vomerine teeth with an indentation medianly on both anterior and posterior sides, while in the second specimen from the same stream the vomerine teeth were normal, that is, lacking any such indentation. Fowler extended the range to the Meping at Chiengmai and the Mekong at Chiengsen. A specimen in the British Museum from the Siamese Museum came from the Menam Chao Phya. The further distribution of the species includes Sumatra, Borneo, and Java.

KRYPTOPTERUS MOOREI, new species

Figure 78

Description.—Body strongly compressed, comparatively deep, its depth at origin of anal fin 3.8 in standard length; least depth of caudal peduncle equal to snout; head moderately depressed, its length 5.8 in standard length, its width 1.5 in its length; dorsal profile of head and anterior part of back regularly concave, posterior 0.8 of back nearly straight; eye in midlength of head, its center in line with cleft of mouth, 4.2 in head, 1.75 in snout, 3 in the strongly convex dorsal interorbital space, 2 in the ventral interorbital space; jaws equal; maxillary extending halfway between tip of snout and posterior border of eye; maxillary barbels 1.25 times length of head, reaching to midbase of pectorals; mandibulary barbels 0.75 length of head; vomerine teeth in a short, straight, elliptical band about 0.6 length of eye.

Fins: Caudal deeply forked, equal to length of head; anal well separated from the caudal, the rays 66; ventrals short, about one-third pectorals, rays i, 7; pectorals about length of head, the rays i, 13, the spine weak and very slightly ossified.

Coloration: Plain.

Type and paratypes.—The type (U.S.N.M. No. 109787) 23.5 cm. long was collected in a small klong off the Menam Chao Phya, near Paknampo, Central Thailand, November 26, 1923. One of the paratypes, obtained at the same time and place, is 17 cm. long. (Paratypes, U.S.N.M. Nos. 109671, 109672, 109786.)

Remarks.—This species is most closely related to *K. hexapterus*, with which it agrees in the absence of a dorsal fin, ventral fin with 8 rays, comparatively deep body, and vomerine teeth in a short, straight band. Differences from *K. hexapterus* are in the longer head (5.8 instead of 6.5 to 7.2 in length in examples of the same size), fewer anal rays (66 against 74 to 83), fewer pectoral rays (i, 13 against i, 16 or i, 17), non-projecting lower jaw, etc.

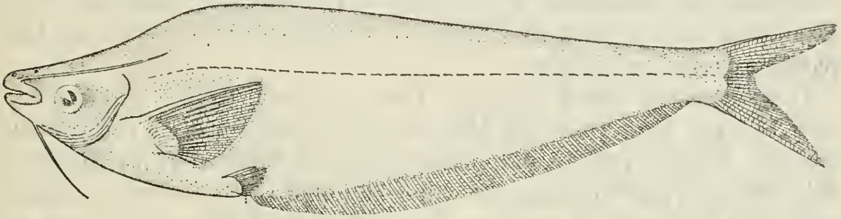


FIGURE 78.—*Kryptopterus moorei*, new species: Type (U.S.N.M. No. 109787). Drawn by Miss Jane Roller.

This species is named for R. Adey Moore, of Bangkok, for many years the efficient honorary secretary of the Siam Society, in slight recognition of his sustained interest in the promotion of zoological science in Thailand.

KRYPTOPTERUS APOGON (Bleeker)

Silurus apogon BLEEKER, 1851 (42), p. 67 (Bandjermassing, Borneo).

Kryptopterus apogon SMITH, 1933a, p. 75 (Menam Chao Phya).—FOWLER, 1935a, p. 96 (Bangkok).

Although previously unknown outside of Sumatra and Borneo, this fish has in recent years been found to be fairly common in the Menam Chao Phya and connecting streams from Paknam to Lopburi.

Examples preserved have been from 12 to 20 cm. long. A length of 77 cm. is reported from the East Indies by Weber and de Beaufort.

The unusually inappropriate specific name of *apogon* is justified by a few Thailand specimens in which the mandibulary barbels are vestigial or altogether lacking.

The fish is called *pla neua on*, *pla deng*, *pla cha oan*, and *pla nam ngeon* in various parts of its range in Thailand.

KRYPTOPTERUS MICRONEMA (Bleeker)

Silurus micronemus BLEEKER, 1846 (4), p. 289 (Batavia).

Micronema typus BLEEKER, 1865 (356), p. 175 (Siam).—SAUVAGE, 1881, p. 161 (Siam).

Cryptopterus micronema WEBER and DE BEAUFORT, 1913, vol. 2, p. 221 (Siam).

Kryptopterus micronema FOWLER, 1934a, p. 87 (Bangkok); 1937, p. 137, figs. 13–15 (Bangkok).

Kryptopterus deignani FOWLER, 1937, p. 136, figs. 10–12 (Mepoon).

The known habitat of this species is Java, Borneo, and Thailand. although it is rare in Thailand. A specimen 19 cm. long, in the

Siamese Bureau of Fisheries, taken in Menam Chao Phya near Bangpa-in, December 10, 1924, agrees well with Weber and de Beaufort's description; the caudal has a black bar at its base and the anal is black-edged. Fowler had 10 specimens 10.5 to 29.8 cm. long taken at Bangkok.

Kryptopterus micronema is close to *K. apogon* and not always readily distinguishable therefrom. The principal character on which the species are separated is the shape of the patch of vomerine teeth. Examples are met with in which it is difficult to decide whether this patch is curved or angular.

It is suggested that *K. deignani* Fowler, known from a single specimen 14.3 cm. long from the Mepoon in Central Siam, is the present species. Fowler (1937) stated that *deignani* differed from Bleeker's *Micronema typus* "in larger or wider bands of teeth, besides a smaller eye," and in having 81 anal rays instead of 86 to 93, as mentioned by Bleeker. *Micronema typus*, however, is a synonym of *Silurus micronema* Bleeker, which is the present species, and in his account of *K. micronema* based on specimens from Bangkok Fowler (1937) gave the anal rays as 76 to 79 and stated that it "differs from *K. deignani* in its greatly smaller eye." The diameter of the eye in relation to the length of the head seems to be extremely variable in this form; thus, *K. micronema* Weber and de Beaufort give the eye in head as 3.5 to 5, Fowler gives 6 to 7, and for *K. deignani* Fowler gives 5.75.

KRYPTOPTERUS BLEEKERI Günther

Cryptopterus bleekeri GÜNTHER, 1864, vol. 5, p. 44 (Siam).—VON MARTENS, 1876, p. 399 (Siam).—HORA, 1923b, p. 166 (Bangkok, Nontaburi).

Micronema bleekeri BLEEKER, 1865 (347), p. 34 (Siam).—BLEEKER, 1865 (356), p. 175 (Siam).—BOCOURT, 1866, p. 17, pl. 4, figs. 3–3c (Menam Chao Phya).—SAUVAGE, 1881, p. 161 (Siam and Cambodia).

With the exception of Indo-China, Thailand is the only known habitat of this species. It is found throughout the length of the Menam Chao Phya; in its tributary the Pasak; and in the Tapi, near Bandon. Specimens from Thailand in the British Museum have been examined by the writer, one from the Bleeker collection, one from the Jamrach purchase, and six from the Siamese Museum.

A length of 60 cm. is attained.

K. bleekeri is found in swamps during high water, and when it enters the rivers it frequents the deeper parts. It is fished for with a peculiar device consisting of a lead jigger armed with four sharp hooks set at right angles; the fish is caught as the hooks go down. A mole cricket is a good bait for ordinary line fishing.

This is a common fish, well known to the Thai under the name *pla deng* (red fish), in allusion to its general color of rose, pink, and other reddish shades. It is a good food, although somewhat inferior in flavor to the *pla biew* (*Wallago dinema* Bleeker).

Family HETEROPNEUSTIDAE

This family was established by Hora (1936a) to accommodate the two known species of *Heteropneustes.* The distinctive characters assigned to the family seem entirely valid, although osteological and other features indicate very close relationship with the Clariidae.

The outstanding anatomical character is a pair of long, hollow cylinders extending backward on each side from the gill cavity among the muscles of the back; these are air sacs that serve as primitive lungs and enable the fish to breathe atmospheric air, although Günther asserts that they receive water and have a special musculature by which water is expelled at intervals. These fishes live in stagnant pools and ditches deficient in oxygen, and no useful purpose would seem to be served by the respiratory tubes if their function is simply to receive the same vitiated water.

Genus HETEROPNEUSTES Müller

Heteropneustes MÜLLER. Arch. Anat. Physiol., 1840, p. 115. (Type. *Silurus fossilis* Bloch.)

HETEROPNEUSTES FOSSILIS (Bloch)

Silurus fossilis BLOCH, 1797, vol. 11, p. 36, pl. 370, fig. 2 (Tranquebar).

Saccobranchus fossilis BLEEKER, 1865 (356), p. 175 (Siam).—SAUVAGE, 1883b, p. 154 (Menam Chao Phya).

Clarisilurus kemratensis FOWLER, 1937, p. 133, figs. 5, 6 (Kemarat).

Heteropneustes kemratensis FOWLER, 1939, p. 56 (correction of generic name) (Trang).

Throughout its range in India, Burma, Ceylon, Indo-China, and Thailand, this is primarily a fish of ponds, ditches, swamps, and marshes, but it is sometimes found in muddy rivers. Its air-breathing apparatus enables it to exist in almost any kind of water. The extensive collecting done in Thailand has not shown the fish to have a wide distribution, but special search in suitable localities should extend its known range. Specimens have been taken in a small lake off the Menam Chao Phya near Paknampo, in a lake off the Menam Nan near its mouth, and in Bung Borapet. There is also a record for the Nakon Nayok. In Bung Borapet it has been found in association with other air-breathers (*Anabas*, *Trichogaster*, *Ophicephalus*, and *Clarias*), in cut-off parts of the swamp.

A maximum length of 30 cm. is attained in Thailand. The usual length is about 20 cm. An example, 27 cm long, taken in Bung Borapet on July 30, 1929, has large ovaries containing clear, practically ripe eggs.

The fish is good to eat but fishermen do not like to handle it because of the painful wounds inflicted with its pectoral spines, which are reputed to be very poisonous.

For a century this fish was referred to in biological literature as *Saccobranchus fossilis* Bleeker, although *Heteropneustes* has priority over *Saccobranchus*, the name having been proposed by Müller in 1839 for *Silurus fossilis* Bloch (1797), while Valenciennes the next year established *Saccobranchus* for *Silurus singio* Hamilton (1822), *singio* being a synonym of *fossilis*.

A supposed new genus of Siluridae, *Clarisilurus*, was described by Fowler (1937), with *C. kemratensis* as the type, based on four specimens, 14.3 to 21 cm. long, from the Mekong at Kemarat in Eastern Thailand. The fish did not possess the characters diagnostic of the Siluridae (such as subcutaneous eyes, gill membranes free from each other and from the isthmus), and was clearly a *Heteropneustes*, as Myers (1938) indicated. The proper allocation was subsequently made by Fowler (1939), who then expressed the view that the species "appears to differ from *H. fossilis* (Bloch) chiefly in more anal rays (75 to 84)." No other features in which the fish differs from *H. fossilis* have been indicated, and it seems altogether probable that *H. kemratensis* should be regarded as a synonym. The anal rays in *H. fossilis* have been described as ranging from 60 to 79, thus overlapping those in *kemratensis*.

The name *pla cheet* is given to the fish in Thailand. It is not known to the writer whether the English name sheat fish for the European catfish *Silurus glanis* implies anything more than a coincidence.

Family CLARIIDAE

The clariid catfishes are of great interest because they have, in addition to gills, an accessory breathing organ occupying the upper part of each branchial cavity. These organs, having an arborescent shape, enable the fish to breathe atmospheric air. The gills are relatively small and appear inadequate to sustain life; fish that are prevented from reaching the surface of a tank or aquarium soon die.

The family is represented in Thailand by two closely related genera, as follows:

1*a*. Dorsal, caudal, and anal fins entirely separated------------------- **Clarias**
1*b*. Dorsal, caudal, and anal fins united------------------------- **Prophagorus**

Much of the material used in the following account is taken from a paper on clariid catfishes (Smith, 1934b).

Genus CLARIAS Scopoli

Chlarias Scopoli, Introductio ad historiam naturalem, p. 445, 1777. (Type, *Clarias orontis* Günther.)

The catfishes of this genus are among the most abundant, most widely distributed, and most important economically of the fresh-water fishes of Thailand. They are eaten extensively in the households of fishermen and farmers, and are regularly offered for sale in the markets of Bangkok and other communities throughout the country. Fish are exposed for sale alive in baskets, in shallow tubs with little or no water, or on stone slabs, like *Anabas* and *Ophicephalus*, and if not sold one day they are taken back to market the next day. The fish have a great reputation for their wholesome qualities, and are in special demand for convalescents and invalids.

The name *Clarias*, first used for these fishes by Gronow in 1763, lost its status as a valid generic name of that author and date with the rendering of the Opinion (No. 89) of the International Commission on Zoological Nomenclature that the systematic names of Gronow are declared eliminated from consideration. This name, like a number of others brought out by Gronow, was validated by Scopoli in 1777, and although credited to Gronow by Scopoli was spelled *Chlarias*. Four other fish names of Gronow validated by Scopoli and credited by him to Gronow were given a different spelling; these were *Holocenthrus* for *Holocentrus*, *Gonovynchus* for *Gonovhynchus*, *Calichthys* for *Callichthys*, and *Mastocembelus* for *Mastacembelus*. It cannot be stated whether the variant orthography of Scopoli was due to deliberate intent, to carelessness, or to typographical error, but inasmuch as Scopoli definitely recognized Gronow as the authority, it seems proper in the case of *Clarias*, as has been generally done in all the other cases, to adhere to the original spelling.

Five species of *Clarias* have been ascribed to Thailand but only three species can be definitely accredited on the information now available. The five species are differentiated as follows:

1*a*. Pectoral spine with strong, sharp, prominent teeth on its anterior border. meladerma

1*b*. Pectoral spine without prominent teeth on its anterior border, which is smooth, rough, or inconspicuously denticulated.
  2*a*. Occipital process more or less angular with rounded tip, its basal width about 2 times its length in medium-sized fish.
    3*a*. Distance from dorsal fin to occipital process contained 4 to 5.5 times in length of head measured along upper median line; dorsal rays 60 to 76; anal rays 47 to 58 ---------------------------------- batrachus
    3*b*. Distance from dorsal fin to occipital process contained 2.5 times in length of head measured along upper median line; dorsal rays 70 to 74; anal rays 60 to 63 ---------------------------------- teysmanni

2*b*. Occipital process wide, low, broadly curved, its basal width 3 to 5 times its length.
  4*a*. Distance from dorsal fin to occipital process contained 2.5 times in length of head measured along upper median line; gill rakers 14; dorsal rays 70 to 78; anal rays 50 ---------------------------------- leiacanthus
  4*b*. Distance from dorsal fin to occipital process contained 5 to 7 times in length of head measured along upper median line; gill rakers over 20; dorsal rays 70; anal rays 50 ------------------------ macrocephalus

CLARIAS MELADERMA Bleeker

Clarias meladerma Bleeker, 1847 (5), p. 54 ("in paludibus").
Clarias melanoderma Károli, 1882, p. 177 (Siam).—Weber and de Beaufort, 1913, vol. 2, p. 188 (Siam).
Clarias dussumieri Smith, 1934b, p. 288 (name incorrectly cited as having priority over *C. meladerma*).

In addition to inhabiting Java, Sumatra, and Borneo, this species is listed from China, the Philippines, and Thailand. It is probable that Weber and de Beaufort credited the species to Thailand on the authority of Károli, whose determinations and localities have sometimes proved to be doubtful. In the very extensive collecting done in Thailand in recent years this species has not been met with, although it may be noted that Chevey (1932a, p. 15) credits both *C. melanoderma* and *C. dussumieri* to French Indo-China.

Day (1878) obtained a single specimen of a fish in the Wynaad River, Malabar, which he identified with *Clarias dussumieri* of Cuvier and Valenciennes from Malabar and Pondicherry. Day's specimen had teeth on the anterior surface of the pectoral spines, and Day assumed therefrom that he was dealing with Bleeker's *Clarias meladerma*, which he placed in the synonymy of *C. dussumieri*. Recently Hora (1936b) has shown that Day's fish was neither *C. dussumieri* (which is synonymous with *batrachus*) nor *meladerma*, but represents a new species that Hora has called *dayi*.

CLARIAS BATRACHUS (Linnaeus)

Silurus batrachus Linnaeus, 1758, p. 305 (Asia, Africa).
Clarias batrachus Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 175 (Siam).—Sauvage, 1881, p. 161 (Siam).—Hora, 1923b, p. 165 (Bangkok).—Vipulya, 1923, p. 227 (Bangkok).—Hora, 1924a, p. 467 (Tale Sap).—Smith, 1934b, p. 289 (Siam generally).—Fowler, 1934a, p. 86 (Chiengmai, Chiengdao); 1934b, p. 335 (Ban Thung Luang).

The range of this species embraces India, Ceylon, Burma, Malaya, Dutch East Indies, Philippines, and French Indo-China. It is the commonest and most widely distributed species of this genus in Thailand, frequenting rivers, canals, lakes, and swamps in all parts of the country. Waters from which specimens were collected by the writer included the Chao Phya River at Bangkok, Ayuthia, and Paknampo;

the Ping River at Raheng, Chomtong, and Chiengmai; the Kok River at Chiengrai; Kwan Payao; the Pasak River; the Rangsit Canal; the Bangpakong River at Prachin; the Klong River at Rajaburi; a small stream on Koh Chang; the Tadi Stream, Nakon Sritamarat; the Tale Sap; the Patani River; and the Seamreap River in Cambodia.

The Deignan collection contains three adult albinos from the Meping at Chiengmai and from a pond, connected with the river, at the Leper Hospital near Chiengmai. Albinism is fairly common in this species.

A maximum length of more than 40 cm. is attained.

This fish, like other members of the genus, experiences no inconvenience when kept out of water for a long time if the respiratory apparatus remains moist. Drying of the gills and arborescent organs is retarded by the small, tightly closed branchial openings. Sometimes the fish voluntarily leaves the water, presumably in search of better living or feeding conditions or perhaps to escape enemies. Movements on land suggest swimming and can be properly described as wriggling, hence the vernacular name. The flat head and extended pectoral fins keep the fish in an upright position as it moves forward by rapid lateral bendings of the tail. On August 13, 1926, a friend brought the writer a fish that in the late afternoon of the previous day was picked up on a metaled driveway in his yard in Bangkok. The fish had left a small canal 15 meters away and was proceeding toward another canal 35 meters away. It was placed in a flat jar of water in the writer's office. It left the jar during the night (apparently by jumping), dropped from a table to the floor, passed through a short corridor, traversed a large exhibit room, went the entire length of a long hallway, and was found in a lively condition just inside the front door at 11 p. m. It was released the next morning, having earned its freedom.

As a food, the fish is very important in Thailand. Its flesh, which is white, is popularly considered rather less nourishing than that of *C. macrocephalus.*

The local name is *pla duk dam* (dull-colored wriggling fish); and a belief is widespread that this is the male of *macrocephalus*, of which the female is called *pla duk uey.*

CLARIAS TEYSMANNI Bleeker

Clarias teysmanni Bleeker, 1857 (166), p. 344 (Tjikoppo, Buitenzorg Province, Java).—Hora, 1923b, p. 165 (Nakon Sritamarat).—Smith, 1934b, p. 290 (Klong Pong, Nakon Sritamarat).

This species, known also from Ceylon, Malaya, Sumatra, Borneo, and Java, has a very limited distribution in Thailand. It was first recorded by Hora from a single specimen, 18 cm. long, taken in February 1922 in the Nakon Sritamarat Mountains, Peninsular Thailand.

On July 12, 1928, the writer took two specimens, 11 and 15 cm. long, from Klong Pong, at Ban Huey Ta, west of the town of Nakon Sritamarat near the base of the lofty Kao Luang.

The local vernacular name for the fish is *pla mod.*

CLARIAS LEIACANTHUS Bleeker

Clarias leiacanthus BLEEKER, 1851 (49), p. 430 (Sambas, Borneo); 1865 (347), p. 35; 1865 (356), p. 175 (Siam).—SAUVAGE, 1881, p. 161 (Siam) (fide Bleeker).—SMITH, 1934b, p. 290 (attributed to Siam).

This species is introduced into this catalog because it has been attributed to Thailand by several authors. The evidence for its occurrence in that country will be considered.

In two papers on Thailand fishes published in 1865, Bleeker listed *C. leiacanthus* on the basis of a specimen or specimens in the Muséum du Jardin des Plantes in Paris collected from the Menam Chao Phya by F. Bocourt, the species having been originally described by Bleeker from Borneo in 1851, and is now recognized as inhabiting also Sumatra, Bangka, and Nias. Until a few years ago, this species had not again been reported from Thailand, all the intervening references in the literature being based on Bleeker's papers. The natural conclusion is that in the extensive collecting done in Thailand rivers in recent years the fish escaped notice or that Bleeker made a mistake in identification.

In the writer's opinion the specimen or specimens from Thailand that Bleeker in 1865 called *C. leiacanthus* were in reality *C. macrocephalus*, described from this country by Günther in 1864. Bleeker was apparently unfamiliar with the latter species which, with its broadly curved occipital process and comparatively smooth pectoral spine, might easily be mistaken for *C. leiacanthus.*

In 1934 Fowler reported as taken at Bangkok two specimens of *Clarias leiacanthus*, 210 and 217 mm. long. Mr. Fowler kindly allowed the examination of one of these specimens. It differs from *C. leiacanthus* as described by Bleeker and by Weber and de Beaufort in the position of the dorsal fin with reference to the occipital process, in the number of gill rakers, in the dorsal and anal fin rays, and in other characters. The distance between the dorsal fin and the occipital process is a feature diagnostic in the clariids. In *C. leiacanthus* this distance is contained 2.5 times in the length of the head measured along the median line, while in Fowler's specimen from Bangkok this distance is contained over 7 times in the length of head. In *C. leiacanthus* the gill rakers on the lower arm of the first arch number 13 (according to Weber and de Beaufort); in the specimen in hand the number exceeds 25. The dorsal rays in *C. leiacanthus* are 76 to 78 and the anal rays 60 to 62, while in Fowler's example the dorsal rays number about 70 and the anal rays about 50. The foregoing and other characters in which the Bangkok specimen differs specifically from *C. leiacanthus* agree perfectly with *C. macrocephalus* Günther (q. v.).

CLARIAS MACROCEPHALUS Günther

FIGURE 79

Clarias macrocephalus GÜNTHER, 1864, vol. 5, p. 18 (Siam).—SAUVAGE, 1881, p. 161 (Siam).—SMITH, 1934b, p. 291 (Siam generally).

Clarias liacanthus FOWLER, 1934a, p. 87 (Bangkok) (nec *C. leiacanthus* Bleeker).

This species was described from Thailand from four adult and half-grown specimens in the British Museum acquired in the Jamrach purchase. It is now known also from French Indo-China and the Philippines.

Its length may exceed 31 cm.

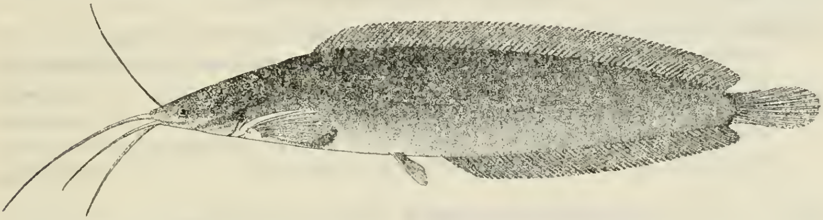


FIGURE 79.—*Clarias macrocephalus* Günther. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

This form is readily recognizable by its large head; broad, low, evenly curved occipital process extending close to the dorsal fin; nasal barbels reaching to or beyond the gill openings; maxillary barbels extending to the middle or tip of the pectorals; vomero-palatine teeth obtusely conical, forming a crescent-shaped band, which in its center is broader than the intermaxillary band; and a nearly smooth pectoral spine.

Günther's description is sufficient to differentiate the species from its nearest ally, *C. leiacanthus*, although Weber and de Beaufort considered *C. macrocephalus* "a rather doubtful species." It does not appear to occur in the Indo-Australian Archipelago, and while Weber reported it from Sumatra in 1894, his specimens were subsequently adjudged to represent *C. batrachus*.

Dr. Frederik P. Koumans, of the Royal Natural History Museum in Leiden, Holland, courteously examined for me specimens of *C. macrocephalus* from three localities in Central Thailand and compared them with Bleeker's cotypes of *C. leiacanthus*. He found the species closely allied but disclosed differences that have already been indicated and others, such as the size of the eye (larger in *C. macrocephalus*), length of barbels (shorter in *C. macrocephalus*), and dorsal and anal rays (fewer in *C. macrocephalus*).

With the exception of *C. batrachus*, this is the commonest and commercially the most important of the Thailand clariids. It is known as *pla duk uey* (*uey*, fat), and is rated higher than *C. batrachus*, its flesh being richer, better flavored, and more nourishing, in popular opinion.

Genus PROPHAGORUS H. M. Smith

Prophagorus H. M. Smith, Copeia, 1939, No. 4, p. 236. (Type, *Clarias nieuhofii* Cuvier and Valenciennes.)

This genus was established to accommodate clariid fishes in which the dorsal and anal fins are completely united with the caudal. The name *Phagorus* (McClelland, 1845) is not available, having been based on a mutilated specimen of *Clarias batrachus*. Until recently only a single species was known. A second species, described from Thailand, is distinguishable by the characters given below:

1*a*. Depth 8 to 9.3 in standard length; dorsal rays 87 to 106; anal rays 69 to 95; vomerine teeth in a crescentic band with a prominent median backward extension-- **nieuhofii**

1*b*. Depth 6.5 in standard length; dorsal rays 67; anal rays 54; vomerine teeth in a slightly curved elliptical band with no median backward extension-- **cataractus**

PROPHAGORUS NIEUHOFII (Cuvier and Valenciennes)

Clarias nieuhofii Cuvier and Valenciennes, 1840, vol. 15, p. 386 (locality not given).

Phagorus nieuhofii Fowler, 1905, p. 461.

Clarias nieuhofi Smith, 1934b, p. 288 (Nong Khor, Hoopbon, Krat River).

Prophagorus nieuhofi Smith, 1939b, p. 236 (new generic name).

Although known from many islands in the Indo-Australian Archipelago, as well as from the Philippines and Malacca, this species has a very limited range in Thailand, being apparently restricted to the southeastern district. The first known recognition of the fish locally was in November 1926, when a specimen 37 cm. long was taken in Nong Khor; its body was marked by 13 transverse rows of white spots equal to or larger than the eye, the side had an irregular longitudinal band of large white spots, and the lower part of the body except the belly was similarly spotted; and the maxillary and mandibulary barbels were longer than described by Bleeker and by Weber and de Beaufort. The second specimen, taken in November 1931, at Hoopbon in the same section was 36 cm. long and had all the barbels greatly reduced in length, possibly by an accident. The only other specimen, 13 cm. long, came from the Krat River near Kao Seming, in December 1933.

The length attained in the Dutch East Indies is about half a meter. In Thailand, the fish is reported to reach a larger size than the specimens taken at Nong Khor and Hoopbon.

The local vernacular name is *pla duk lampan.*

PROPHAGORUS CATARACTUS (Fowler)

Phagorus cataractus FOWLER, 1939, p. 54, figs. 1–3 (Trang).

Described from a single specimen, 21 cm. long, from a waterfall stream near Trang, this species appears to differ from *P. nieuhofii* not so much in most of the characters cited by Fowler (length of barbels, position of the dorsal fin, length of ventral fins, size of caudal fin, and degree of spottiness, all of which might vary with age) as in the vomerine dentition and the number of dorsal and anal rays, as well as in the relative depth of body. The dorsal rays number 67, as against 87 to 106 in *P. nieuhofii*, the anal rays are 54, compared with 69 to 95, and there is no backward median projection in the band of vomerine teeth, which in *P. nieuhofii* is a characteristic feature. The greatest depth of body is contained 6.5 times in the standard length, while in *P. nieuhofii* it is 8 to 9.3.

Family PLOTOSIDAE

Genus PLOTOSUS Lacepède

Plotosus LACEPÈDE, Histoire naturelle des poissons, vol. 5, p. 129, 1803. (Type, *Platystacus anguillaris* Bloch.)

These fishes are primarily marine but are often found in estuaries and the mouths of rivers, and sometimes push well up into fresh water. Of the four or five species known from southeastern Asia and the Indo-Australian Archipelago, two are common in Thailand:

1*a*. Dorsal rays 80 to 100; anal rays 70 to 80; vomer with a crescentic band of teeth, of which the mesial teeth are in 2 or 3 rows; mandibular teeth in 2 or 3 rows; nasal barbel short, not reaching beyond eye; gill rakers on first arch 25 ---------- lineatus

1*b*. Dorsal rays 130 to 140; anal rays 105 to 120; vomer with a crescentic band of teeth, of which the mesial teeth are in 4 rows; mandibular teeth in 3 to 5 rows; nasal barbel longer, reaching well behind eye or even to nape; gill rakers on first arch ---------- canius

PLOTOSUS LINEATUS (Thunberg)

Silurus lineatus THUNBERG, 1791, p. 190 (Indian Ocean).

Plotosus anguillaris VON MARTENS, 1876, p. 399 (Bangkok).—WEBER and DE BEAUFORT, 1913, vol. 2, p. 229.—SMITH, 1930, p. 54 (Siam).—FOWLER, 1937, p. 133 (Paknam Chao Phya).

Plotosus lineatus SMITH, 1941a, pp. 15, 16 (revival of first available specific name).

Of very wide distribution in the Pacific and Indian Oceans, and of common occurrence in the Gulf of Siam, this species was not found in fresh water in the extensive collecting done for the Siamese Bureau of Fisheries, and its admission to this catalog is based on Fowler's record of eight specimens from Paknam, near the mouth of the Menam Chao Phya. Paknam is the headquarters of a large number of fishermen operating traps and other apparatus in the Gulf of Siam, their catch being sent to Bangkok by water or rail. Many fish of this species are often caught in the traps, but all are small and their food and market value is low.

This fish reaches a length of 25 to 30 cm., and it is respected by fishermen because of the very painful, sometimes dangerous, wounds inflicted with its serrated dorsal and pectoral spines.

Among the Thai it is called called *pla duk tale*, *pla sam keo*, and *pla pet keo.*

PLOTOSUS CANIUS Hamilton

Plotosus canius HAMILTON, 1822, pp. 142, 374 (Bengal).—BLEEKER, 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—HORA, 1924a, p. 467 (Tale Sap).—SMITH, 1930, p. 54 (Siam).—FOWLER, 1935a, p. 96 (Bangkok, Sriracha).

Plotosus caninus HORA, 1923b, p. 166 (Menam Chao Phya at Nontaburi).

The range of this fish is from India, Burma, and Ceylon to Thailand, Malaya, and Indo-Australian Archipelago, in the sea, in estuaries, and in the lower courses of rivers. The species abounds on the coasts of Thailand and goes up some of the rivers into water that is quite fresh. In the Menam Chao Phya it is regularly found as far as Nontaburi, some miles above Bangkok, but is most common in the Paknam section; a length of 75 cm. is reached in this river. In the Chantabun River it is at times numerous, as in June 1926, when over a hundred were observed in the local market in one day, the largest 58 cm. long.

The vernacular name for this fish in Thai is *pla duk tale.*

Family SCHILBEIDAE

The schilbeid catfishes of Thailand constitute a striking and well-marked group. Some of them are among the largest fresh-water fishes of Asia. The family name is derived from *Schilbe*, the oldest genus (Oken, 1817). Weber and de Beaufort and others have given the family as the Pangasiidae, from *Pangasius* (Cuvier and Valenciennes, 1840). Jordan (1923) separated the Pangasiidae from the Schilbeidae, with the Clariidae interposed, placing therein *Pangasius* and the nominal genera *Pseudopangasius* Bleeker (1862) and *Neopangasius* Popta (1904). In all important structural characters *Helicophagus*, *Laides*, and *Pangasianodon* are too close to *Pangasius* to warrant separation therefrom in a distinct family.

The seven local genera may be distinguished without much difficulty. A convenient differential feature is the number of pairs of barbels, taken in conjunction with the vomero-palatine teeth. Other distinguishing characters are as follows:

1*a*. Four pairs of barbels (nasal, maxillary, mandibulary, and mental).
  2*a*. Cleft of mouth not extending under eye; vomero-palatine teeth in a crescentic band which is divided or constricted into several parts; air bladder large, dorsoventrally flattened, free and closely applied to dorsal wall of abdomen---------------------------------- **Platytropius**
  2*b*. Cleft of mouth extending under eye; vomero-palatine teeth in an uninterrupted crescentic band produced backward at sides; air bladder small, tubiform, partly enclosed in bone---------------------- **Eutropiichthys**
1*b*. Two or three pairs of barbels (nasal barbels absent).
  3*a*. Two pairs of barbels (maxillary and mandibulary).
    4*a*. Vomerine and palatine teeth present, these and jaw teeth disappearing with age in some species; posterior nostril nearer to anterior nostril than to eye and above a line from anterior nostril to upper edge of eye; eye more or less in line with a horizontal through angle of mouth.
      5*a*. Abdomen rounded-- **Pangasius**
      5*b*. Abdomen cultrate---------------------------------- **Pteropangasius**
    4*b*. Vomerine teeth present, palatine teeth absent; posterior nostril about midway between anterior nostril and eye and in line from anterior nostril to upper edge of eye; eye above a horizontal through angle of mouth-- **Helicophagus**
  3*b*. Three pairs of barbels (maxillary, mandibulary, and mental); vomerine teeth in 2 separate transverse bands---------------------------- **Laides**
1*c*. One pair of barbels (maxillary); eye below level of angle of mouth; teeth entirely absent. Size colossal. Mekong basin----------- **Pangasianodon**

Genus PLATYTROPIUS Hora

Platytropius Hora, Journ. Siam Soc., Nat. Hist. Suppl., vol. 11, p. 39, 1937.

Platytropius is separated from *Pseudeutropius* chiefly on the character of the vomero-palatine teeth and the shape of the air bladder. In *Pseudeutropius*, with one species in Sumatra and several in India, the vomero-palatine teeth are in a single continuous band while in *Platytropius* these teeth are in distant patches that form a lunate band constricted or divided in the median line and divided or constricted into two, exceptionally three, parts on each side. The air bladder in *Pseudeutropius* is thin walled and comes in contact with the abdominal parietes above each pectoral fin, resulting in the formation of a translucent area, while in *Platytropius* the organ is thick walled, dorsoventrally flattened, and throughout lies close to the dorsal wall of the abdominal cavity.

PLATYTROPIUS SIAMENSIS (Sauvage)

Figure 80

Pseudeutropius siamensis Sauvage, 1883b, p. 154 (Menam Chao Phya).—Smith, 1934b, p. 297 (Menam Chao Phya, Menam Nakon Nayok).
Platytropius siamensis Hora, 1937a, p. 352 (Siam).—Hora, 1937c, p. 39, figs. 1, 2, pl. 11 (with 4 figures) (Siam).
Nemasiluroides furcatus Fowler, 1937, p. 137, figs. 16–19 (Bangkok).
Pseudeutropius taakree (*non* Sykes) Smith, 1934b, p. 297 (Menam Chao Phya).

In 1883 Sauvage described *Pseudeutropius siamensis* from a specimen, 13.5 cm. long, collected by Dr. Harmand in the Menam Chao

Phya. During the next 40 years the species received no notice. In November 1923 the writer found the fish fairly common in the uppermost reaches of the Menam Chao Phya and preserved 6 specimens about 25 cm. long. In 1928 he observed the fish in the Menam Nakon Nayok, a branch of the Bangpakong connected by canals with the Menam Chao Phya, and preserved 2 specimens. More recently additional specimens have been obtained by the Siamese Bureau of Fisheries from the Paknampo section of the Menam Chao Phya.

This species was placed by Hora in his genus *Platytropius.*

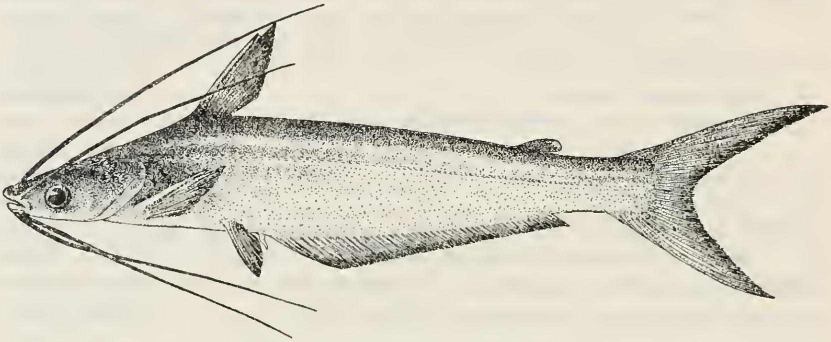


FIGURE 80.—*Platytropius siamensis* (Sauvage). Drawn by Luang Masya; courtesy of the Thailand Government.

The Indian fish *Pseudeutropius taakree* (Sykes) was improperly listed by the writer (1934b, p. 297) as occurring in Thailand on the basis of a specimen so labeled in the British Museum collected in the Menam Chao Phya and donated by the Siamese Museum in 1897. This specimen was examined by Hora and found to be *P. siamensis.*

Fowler's *Nemasiluroides furcatus*, based on four specimens, 10.3 to 11.5 cm. long, collected in Bangkok, appears to be the present species. The genus *Nemasiluroides*, described as new in May 1937, seems to have been anticipated by Hora's *Platytropius*, briefly diagnosed and type species indicated in January 1937, but with full description not appearing until November 1937.

Genus EUTROPIICHTHYS Bleeker

Eutropiichthys BLEEKER (299), Versl. Akad. Amsterdam, vol. 14, p. 398, 1862. (Type, *Pimelodus vacha* Hamilton.)

EUTROPIICHTHYS VACHA (Hamilton)

Pimelodus vacha HAMILTON, 1822, pp. 196, 378 (Gangetic provinces).
Eutropiichthys vacha HORA, 1937b, p. 436, fig. 5a (Siam).

This widely distributed species of India and Burma was added to the Thai fauna in 1932, when a specimen, 31 cm. long, collected by the Royal Forest Department of Siam at Maesort, on the Menam Muey, a tributary of the Salwin, in Western Thailand, was identified and recorded by the writer. This is the only Thailand specimen of which he has knowledge, and it seems to be the one described and figured by Hora (1937b), who concludes that the Thailand and Burmese forms, while differing in some respects from the Indian, cannot, from the material available, be separated therefrom as races or subspecies (variety *burmanicus* of Day).

At Maesort the vernacular name applied to this fish is *pla sawai nu*, borne by related catfishes in other parts of Thailand.

Genus PANGASIUS Cuvier and Valenciennes

Pangasius Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 15, p. 45, 1840. (Type, *Pimelodus pangasius* Hamilton.)

This is the most numerous genus of Thailand catfishes. All the species inhabit the larger rivers and some of them are amenable to pond life. The principal differential characters are to be found in the dentition, barbels, anal rays, and coloration. Two of the largest catfishes in the world belong here. While all the species are carnivorous, some of them thrive on fruit or aquatic vegetation, especially when loss or atrophy of teeth necessitates abandonment of a predatory career. In certain species the phenomenon of the partial or complete disappearance of the teeth after a certain size or age is reached has been critically examined, and it is probable that one nominal genus (*Pangasianodon*), based largely on the complete absence of teeth, represents simply a normal age stage of a *Pangasius*.

As all these fishes are of striking appearance and some of them have come into local prominence because of their economic importance, it is natural that they should have acquired many vernacular names in different parts of their range. Some of the names, like *pla tepo* and *pla tepa*, are applied to only a single species; others have come to be used for groups of species of similar appearance, like *pla sangkawad* and *pla sawai*. For some individual species of wide distribution there is a large number of local names. Finally, the same species may bear different names in the same locality when young and when adult.

The 15 local species, some peculiar to Thailand or to the boundary waters of Thailand and Indo-China, and some of them known from very scant material, may be identified as follows:

1*a*. Patches of vomerine teeth separated from each other but united with or closely contiguous to palatine patches.

  2*a*. A large black humeral spot always present; no black longitudinal band along side; each caudal lobe with or without a submarginal black longitudinal band; anal rays 28 to 33______________________________ larnaudii

2*b*. No black humeral spot.

3*a*. A single broad black longitudinal band on side; caudal lobes plain; anal rays 36 to 40-------------------------------- pleurotaenius

3*b*. Several broad black longitudinal bands on side; caudal lobes blackish, with pale edge; anal rays 34 to 36------------------------ **sutchi**

1*b*. Vomerine teeth united into a single quadrate patch, with a patch of palatine teeth on each side close to but not joined to vomerines.

4*a*. Patch of vomerine teeth about 3 times as wide as its antero-posterior diameter; patches of palatine teeth extending outward and backward from side of vomerine patch; anal rays 29 to 31.

5*a*. Caudal peduncle long and slender, its least depth contained 2.5 to 3 times in its length; maxillary barbels reaching pectoral fins, 0.65 to 0.75 length of head; head moderately depressed; snout very long; eyes entirely above level of mouth; first dorsal ray shorter than head---- nasutus

5*b*. Caudal peduncle short, its least depth less than 0.5 its length; maxillary barbels reaching opercles, less than 0.5 length of head; head very broad and depressed, snout short; eyes partly below level of mouth; first dorsal ray longer than head---------------------------------- **beani**

4*b*. Vomerine teeth in a large quadrate patch, its antero-posterior diameter 0.7 to 0.8 its width; patches of palatine teeth small and closely applied to the outer sides of the vomerine patch, anal rays 35 to 40----- **polyuranodon**

1*c*. Vomero-palatine teeth in a single fully united crescentic patch; anterior dorsal, ventral, and pectoral rays produced into long filaments; a conspicuous white humeral spot. Size large. Menam Chao Phya basin--- sanitwongsei

1*d*. Vomero-palatine teeth in 4 separate patches that are (1) regularly crescentic in shape or (2) with the palatine perpendicular to the vomerines.

6*a*. Palatine patches of teeth more or less at right angles to vomerine patches; maxillary barbels less than 0.5 length of head; anal rays 42------ **fowleri**

6*b*. Palatine patches of teeth forming a crescentic band with vomerines.

7*a*. Maxillary and mandibulary barbels shorter than head; anal rays 28 to 34.

8*a*. Maxillary barbels less than 0.5 length of head; mandibulary barbels less than 0.25 length of head; distal part of dorsal, caudal, and pectoral fins blackish-------------------------------- micronemus

8*b*. Maxillary barbels more than 0.5 length of head and extending to base of pectoral fins.

9*a*. Mandibulary barbels not exceeding 0.5 length of head; anal rays 31 to 34; coloration of caudal fin plain--------------- pangasius

9*b*. Mandibulary barbels more than 0.5 length of head; anal rays 28 or 29; caudal fin with well-defined dark submarginal band in each lobe-- taeniurus

7*b*. Maxillary barbels longer than head; mandibulary barbels equal to or longer than head; anal rays 30 to 44.

10*a*. Maxillary barbels extending to middle or tip of pectoral fins or to base of ventral fins; anal rays 29 to 36.

11*a*. A large round blackish spot on opercle; vomero-palatine teeth in 4 round equal patches; anal rays 33 or 34--------- aequilabialis

11*b*. No large dark spot on opercle; patches of vomerine and palatine teeth of dissimilar shape and size.

12*a*. Anal rays 30 or 31-------------------------------- macronemus

12*b*. Anal rays 33 to 36------------------------------------ siamensis

10*b*. Maxillary barbels extending beyond origin of anal fin; anal rays 42 to 44-- longibarbis

PANGASIUS LARNAUDII Bocourt

FIGURE 81

Pangasius larnaudii BLEEKER, 1865 (347), p. 34 (nomen nudum) (Siam).—BOCOURT, 1866, p. 15, pl. 4, figs. 2, 2a (Siam).—HORA, 1923b, p. 167 (Nontaburi).—VIPULYA, 1923, p. 227 (Paknampo, Pakhai).

Pangasius larnaudi BLEEKER, 1865 (356), p. 175 (nomen nudum) (Siam).—SAUVAGE, 1881, p. 162 (Siam, Grand Lakes of Cambodia); 1883b, p. 154 (Menam Chao Phya).

Pangasius burgini FOWLER, 1937, p. 141, figs. 24–26 (Bangkok).

Described from Thailand by Bocourt in 1866, this species is peculiar to that country and to the adjoining parts of Indo-China. It is probably the commonest and best-known member of the genus in Thailand, and one of the most popular of the local catfishes. Its natural range is restricted to the Menam Chao Phya and connecting streams in the great central plain, and specimens have been collected and examined critically from below Bangkok to Paknampo. The local range may in time be considerably extended by the escape of fish from artificial ponds.

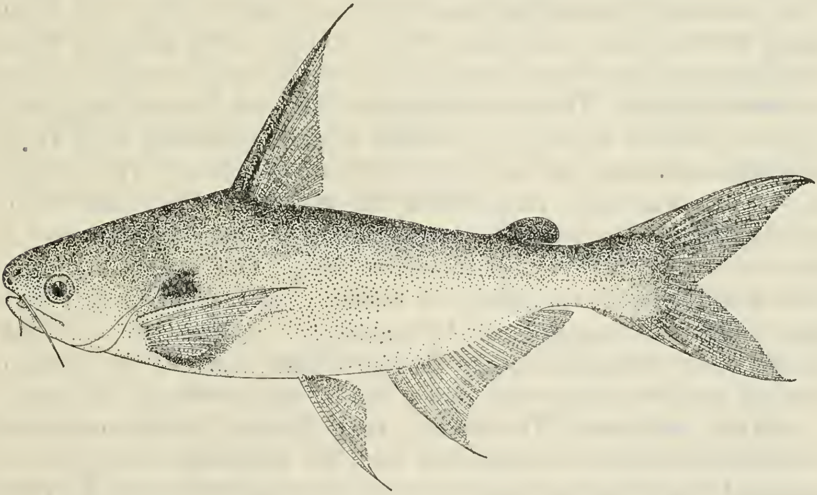


FIGURE 81.—*Pangasius larnaudii* Bocourt. Drawn by Luang Masya; courtesy of the Thailand Government.

The fish is most readily recognized by a large round black humeral spot, possessed by no other species, together with a gray-blue back, light green head, silvery or nacreous underparts, silvery iris, and vermilion ventral and pectoral fins.

Owing to the high repute in which the fish is held for food and its ready adaptability for life in small enclosures, its rearing in ponds for domestic use and sale has been practiced commercially for at least 80 years. Young fish from open waters are introduced in the ponds and held until they have attained a size suitable for consumption or sale. There is no evidence that eggs are hatched and young are raised in the ponds, although pond culture in the true sense seems entirely feasible and will in time doubtless be undertaken. With a fish that commands such a ready sale at a comparatively high price, the construction of suitable ponds and the conduct of the business along well-proved modern lines would seem profitable as a substitute for the present primitive procedure, which leaves much to be desired in the matter of economical use of the water area, production of maximum output, and observance of fundamental hygienic conditions in feeding, growing, and holding the fish.

A noteworthy lot of domesticated fish of this species may be seen in small klongs belonging to Phya Suriwongse Wiwadhana at his residence in Tonburi, Bangkok. These fish, numbering several hundred mostly of large size, resulted from a pair of fishes brought from Ayuthia more than 55 years ago by Phya Suriwongse's father. They are fed, rather irregularly, on bananas, which are their favorite food, but they will eat almost any kind of fruit or vegetable. They are very tame and will take bananas out of one's hand. They will devour small live fish that may enter their enclosure from adjacent klongs but have apparently lost the ability to make way with fish of any considerable size. Thus, a catfish somewhat over a meter long, which tried to swallow a *pla ka* (*Morulius chrysophekadion*) only 15 cm. long became choked, and after several hours of futile effort to swallow its capture had to be pulled from the water and the seized fish removed from its gullet. The largest fishes in this lot, when seen by the writer in 1929, were 127 to 130 cm. long. One caught and examined was 105 cm. long; and it is a matter of some interest, in view of the tendency of some species of *Pangasius* to undergo loss or atrophy of the teeth with age, that in this particular example the bands of teeth in the jaws and on the vomer and palatines were of full size.

During his visit to Thailand in 1862, Bocourt became acquainted with this fish, and in connection with his published description he supplied the following note. The "vast lakes" to which he refers were then in Thailand but are now in the province of Cambodia in French Indo-China.

> The gratitude which I owe to Father Larnaudie of the foreign missions, correspondent of the Museum of Natural History, for the friendly aid he rendered to me during my sojourn in Siam and the memory of our good relations which were so precious to me during the seven months I passed in that country, induce me to dedicate to him this species, native of the vast lakes situated in the north of the kingdom. It is said to attain the great size of 1 to 1.50 meters. Its flesh is extremely nutritious and delicate; it is reared and fattened at Ayuthia, in water courses which are enclosed by bamboo grills. Owing to its high price, the species does not appear in the markets of Bangkok; also it is reserved for the table of important persons.

The first reference to the fish under its scientific name was in two papers published by Bleeker in 1865. Bleeker may have had access to Bocourt's manuscript or at any rate had knowledge of Bocourt's contemplated use of the name *Pangasius larnaudii* for a new species.

It is believed that *Pangasius burgini* Fowler (1937) will prove to be *P. larnaudii*, which although one of the commonest members of the genus in the Bangkok region was not noticed in any of Fowler's papers. *P. burgini* was described and is known from a single specimen, 23.2 cm. long, from Bangkok, and was stated by its describer to be related *P. taeniurus* and *P. sutchi* "but differs from both in coloration, and especially in the presence of the gray black large post-humeral blotch." Each caudal lobe has a broad black median band which is connected with its fellow by an extension of the color across the base of the fin. The maxillary barbels do not reach the base of the pectoral fin. The vomero-palatine teeth are in a curved band on each side, with a median space but with no apparent division of the band into vomerine and palatine parts. The branched anal rays number 27, as against at least 25 in *P. larnaudii*. The reduced number of gill rakers—5+7 on the first arch in *P. burgini*—is met with also in *P. larnaudii;* a specimen from Bangkok of the same size as the type of *P. burgini* has 4+9 gill rakers. In all important characters there seems to be essential agreement between the two forms.

The vernacular name always given to this fish is *pla tepo*, and this name is never applied to any other species.

PANGASIUS PLEUROTAENIUS Sauvage

Pangasius pleurotaenia SAUVAGE, 1878b, p. 235 (Laos, Indo-China); 1883b, p. 154 (Menam Chao Phya).

Describing this fish from Cambodian Laos in 1878 and redescribing and figuring it from Cambodia in 1881, Sauvage (1883b) noted it again in a collection obtained in the Menam Chao Phya by Harmand. This is the only record of the species for Thailand, unless *P. sutchi* Fowler should prove to be the same. The principal characters on which the species was based are the separation of the bands of vomerine teeth and their union with the palatine teeth, maxillary barbels reaching opercles, 36 to 40 anal rays, back and upper part of head black, and a straight black band extending along the side of the body. Sauvage placed the fish in the same group as *P. larnaudii* because of similarity of dentition.

A length of 16 cm. is given.

PANGASIUS SUTCHI Fowler

Pangasius sutchi FOWLER, 1937, p. 141, figs. 27–29 (Bangkok).

Described from four specimens, 13.3 to 16.3 cm. long, from the Menam Chao Phya at Bangkok, this species is represented as strikingly marked with a broad, straight dark median band from the head to the base of the caudal fin, a decurved dark band from the head to a point over the posterior part of anal fin (this band broad anteriorly and tapering to a point posteriorly), the bands separated from the blackish back and from each other by whitish interspaces; dorsal fin gray-black, with a whitish posterior edge; caudal dark gray or gray-black, with upper, lower, and posterior margins whitish; anal white, with a median black band; and paired fins mostly gray-black. · The maxillary barbel reaches to or nearly to the base of the pectoral fin, and the mandibulary barbel to the center of or beyond the eye. The anal rays are iv, 30 to iv, 32. The description makes no reference to palatine teeth, but the published figure suggests that the palatine teeth may be represented in the widened posterior ends of the well-separated vomerine patches.

This species appears to be close to *P. pleurotaenius* but is of a different coloration, especially in the possession of a second longitudinal blackish band.

PANGASIUS NASUTUS (Bleeker)

Pseudopangasius nasutus Bleeker 1863 (324), p. 72 (Borneo).

There were no Thailand records for this Bornean and Sumatran species until the writer found it in the upper Menam Chao Phya. It is confined to that river and collateral streams, and is rather uncommon. Localities from which specimens have been preserved are Paknam, Koh Yai. Angtong, Paknampo, and the Bangham River at Lopburi.

A length of 50 cm. is reported from the Koh Yai section, and one specimen over 41 cm. long was collected there. The usual run of the fish taken for market is 25 to 35 cm. long. The smallest examined, taken at the head of the Menam Chao Phya in the vicinity of Paknampo in November, was 17.5 cm. long. The maximum length reported by Bleeker for the Dutch islands was 90 cm.

The species may be recognized easily by the comparatively long prominent snout and the position of the eyes, which are entirely above the level of the angle of the mouth.

In life, the general color is light gray, with the belly pure white, the top of the head ash green, and the underside of the head golden.

The vernacular name given to this fish is *pla saiyu* (hinge fish), sometimes modified to *pla saiyu puek* (albino hinge fish).

PANGASIUS BEANI H. M. Smith

Pangasius beani Smith, 1931a, p. 26 (Lopburi River).

Only a single specimen of this species has been obtained; it is 20 cm. long and came from a klong off the Lopburi River near Ayuthia. The fish is easily recognizable by its very broad and strongly depressed head, rather short body, steep dorsal profile, and short barbels, combined with the union of the vomerine teeth into a single quadrate patch and detached elongate patches of palatine teeth which with the vomerine form a regular crescent. The type is in the U. S. National Museum, No. 90308.

PANGASIUS POLYURANODON Bleeker

Pangasius polyuranodon Bleeker, 1852 (55), p. 425 (Bandjermassing, Borneo).—Sauvage, 1883b, p. 154 (Menam Chao Phya).—Weber and de Beaufort, 1913, vol. 2, p. 257 (Siam).

The range of this species extends from Java, Borneo, and Sumatra to Thailand and Cambodia. The fish haunts the lower reaches of the Chao Phya and Bangpakong Rivers, and has not been recorded from other Thailand streams. In the first-named river it has been taken at Paknam, Bangkok, Nontaburi, and Koh Yai. Specimens were obtained in June from a pongpang net in the Bangpakong above the village of the same name near the river's mouth and in July from a seine at a point 8 miles from the Gulf of Siam.

This is one of the two pangasiids that have been reported from the Gulf of Siam. Two specimens about 45 and 52 cm. long were obtained in August from the gulf off the mouth of the Menam Chao Phya. As this was during the flood season, when an enormous volume of fresh water was pouring out of the river and extending far off shore, the occurrence of a fresh-water fish in that area was of no special significance. Both of these specimens had small bivalve mollusks in their stomach.

Among the characters by which the species may be recognized are the rather slender form (depth 5 to 5.3 in standard length); maxillary barbels extending to or slightly beyond the base of the pectoral fins; a large rectangular patch of vomerine teeth flanked by a small lenticular mass of palatine teeth; and long anal fin with 35 to 40 rays.

The fish is not very common, but occasionally a large catch is made by the seine fishermen. In May 1928 many 30 to 40 cm. long reached the Bangkok markets from the important fishing grounds at Koh Yai.

The usually employed vernacular name is *pla sawai*. On the Bangpakong the fish is sometimes called *pla sangkawang*, a name said to imply a fish inhabiting deep holes in the river bed, not to be confused with *pla sangkawad*.

PANGASIUS SANITWONGSEI H. M. Smith

Figure 82

Pangasius sanitwongsei Smith, 1931a, p. 29, figs. 13, 14 (Menam Chao Phya).

This interesting species is peculiar to Thailand. Its range is restricted, for it is a fish of the largest rivers, and is seldom, if even, met with outside the basin of the Menam Chao Phya. In the main river it occurs from below Bangkok to its head at Paknampo, and in the main affluents it may also be found. The larger fish remain in the deeper parts of the rivers, and only the young are likely to be observed in the minor tributaries not far from the parent stream. In the Meping it has been taken above Raheng and probably goes upstream as far as the rapids. There are no very definite records for the Menam Nan, the other major tributary entering the head of the Menam Chao Phya. An old fisherman, who spent most of his life on Bung Borapet and was very familiar with the local fishes, stated that this fish did not enter the swamp during the annual inundation but was to be found in the large rivers near the outlets of the swamp.

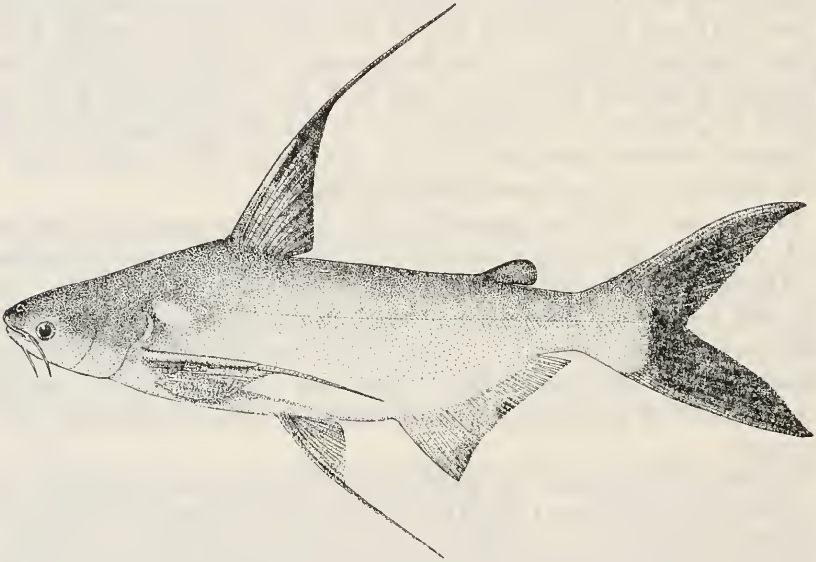


Figure 82.—*Pangasius sanitwongsei* H. M. Smith. Drawn by Luang Masya; courtesy o the Thailand Government.

This is one of the largest fresh-water fishes occurring in any part of the world, and in Thailand it exceeds in size any other fish found wholly within the limits of the country. Examples over a meter in length are not rare. A number up to 1.5 meters were examined by the writer. The largest fish actually seen and measured was 2.5 meters long, and there are various other definite records of fish of that size. There is no doubt as to the authenticity of accounts of fishes 3 meters long, and many people now living have seen or caught fishes that size, but such colossal examples have been taken very rarely within the past 25 or 30 years. A fish 3 meters long would have a maximum thickness of nearly 1 meter and would require the combined strength of eight men to lift and carry it. Old fishermen in the Ayuthia and

Paknampo sections report having known of the capture in their early days of fish somewhat over 3 meters long. It would probably be safe to assert that fish 3 meters or more in length may never again be observed. The smallest specimens obtained were 9 to 10 cm. long. Most of the fish reaching the Bangkok market from the upper river in recent years were 40 to 60 cm. long.

This fish rivals in size the celebrated *pla bük* (*Pangasianodon gigas*) of the Mekong, but it is not to be confused therewith, having entirely different appearance and structural details. Outstanding features are the vomero-palatine dentition, the greatly produced filamentous rays in the dorsal, caudal, anal, ventral, and pectoral fins, the enormous pectoral spines which in the largest examples may have a length of 60 cm., and the conspicuous white humeral spot.

The fish is not very common, and its numbers appear to be decreasing yearly with the increase in the activity and efficiency of fishing operations. It is not the object of a special fishery but is taken incidentally in seines and traps used for miscellaneous fishes. During high-water stages it frequents deep holes in the rivers and is then rarely caught.

Owing to its formidable pectoral spines, the fish is always handled by the fishermen with great circumspection. In 1925 a fish 2.5 meters long was caught in a cast net above Raheng, and when the fisherman dived to clear the net the fish inflicted a deep stab wound in the side, from the effects of which the man died.

There have been no observations on the spawning habits, spawning grounds, hatching, and rate of growth.

In popular estimation the food value of this fish is less than that of other large pangasiids, such as *pla tepo* (*P. larnaudii*) and *pla sawai* (*P. pangasius*). The reputation is based in part on the inferior quality of the flesh and in part on the feeding habits of the fish, for it is known to have a fondness for dogs, whose floating carcasses are common throughout the river. When large fish are to be sent to market, it is sometimes the practice to cut off the fins and thus remove a ready means of identification.

This fish is very well known throughout its range and is called *pla thepa,* a name never applied to any other species.

PANGASIUS FOWLERI H. M. Smith

Pangasius fowleri SMITH, 1931a, p. 28 (Lopburi River).—FOWLER, 1935a, p. 98, fig. 18 (Srisawat).

This is apparently a rare species. The type, 19.5 cm. long, taken in the Lopburi River at Lopburi in October 1926 was the only specimen known until Fowler (1935a) recorded a specimen 20.3 cm. from the east branch of the Meklong at Srisawat.

The species resembles *P. micronemus*, but it may be distinguished therefrom by the very different arrangement of the vomero-palatine teeth and by the more numerous anal rays, as shown in the key.

PANGASIUS MICRONEMUS Bleeker

Pangasius micronemus Bleeker, 1847 (7), p. 8 (Java).
Pangasius micronema Hora, 1923b, p. 167 (Nontaburi).

Formerly known only from rivers of Java, Borneo, and Sumatra, this species was shown by Hora to inhabit Thailand, and in 1937 Herre and Myers reported it from Perak, in Malaya. In Thailand the fish appears to be confined to the Menam Chao Phya. Specimens have been taken from Bangkok to Paknampo, but the fish is not common anywhere.

A length of more than 50 cm. is reported for the Indo-Australian Archipelago. The largest observed in Thailand have been 45 cm. long, and various examples 30 to 40 cm. long have been examined.

The very short maxillary barbels (less than half the length of the head), in association with the disconnected vomero-palatine teeth in a regular crescentic band, enable one to identify this species without much difficulty.

Throughout its local range this fish bears the name *pla sawai*, borne by various other species. A distinctive appellation recorded by Hora (1923b) for Nontaburi on information supplied by Dr. Malcolm Smith is *pla sangkawart tong to*.

PANGASIUS PANGASIUS (Hamilton)

Pimelodus pangasius Hamilton, 1822, pp. 163, 376, pl. 33, fig. 52 (Bengal).
Pangasius pangasius Hora, 1923b, p. 167 (Bangkok).—Vipulya, 1923, p. 227 (Bangkok, Bang-pa-in, Lopburi River, Menam Chao Phya).

In addition to inhabiting India and Burma, this fish frequents Java and Thailand. It was first recorded for Thailand by Hora (1923b) and it has since been found to range throughout the Menam Chao Phya and to occur also in the Menam Sak and the Meklong. It used to enter Bung Borapet at the flood season and was often abundant at the mouths of the outlets of the swamp.

In April and May 1928 a klong on the extensive grounds of the residence of the Adviser in Foreign Affairs in Bangkok was pumped out and the presence of some large examples of this fish was disclosed; they had gained access from the Menam Chao Phya by way of other klongs and had evidently been in this place for some years. Seven examples were caught with a cast-net on May 2 and three were examined. The three largest were 85, 89, and 90 cm. long, and the last was 20 cm. deep and weighed 18 pounds. In all these large individuals the band of vomero-palatine teeth had become reduced in a thin line buried in the soft tissues, and was invisible and scarcely appreciable by touch; the jaw teeth also were greatly reduced in size and in width of band.

The flesh of this fish is very white, fine-grained, and sweet, and commands ready sale.

Bleeker (1862 (301), vol. 2, p. 73), referring to this fish under the name of *Pangasius djambal*, recorded that it reached a length of about a meter, was very common in the large rivers of Java, and contributed materially to the food supply of the people of the interior of the island; the flesh was much esteemed. A length of more than 120 cm. is given by Day for Indian rivers. The largest fish actually measured in Thailand have been a little less than a meter long.

Following are the life colors and other features of a fish caught on a night-line, baited with a large blattid, at Bang Sorn, on the Menam Chao Phya above Bangkok, October 4, 1926. The vomerine teeth were in 2 separate quadrate patches as broad as the eye, flanked by 2 narrow lenticular palatine patches as long as the eye. The maxillary barbels barely reached the base of the pectoral fins. The anal rays were iii, 28 or 29. The axil of the pectoral fins had 4 distinct pores. Back light gray-green, top of head light green, sides pearly white, belly dazzling white, sides of head and front jaws pure creamy white; dorsal fin hyaline-pink, caudal mostly pink, with dorsal part of upper lobe gray, anal hyaline distally, pink at base, ventrals and pectorals hyaline, adipose fin green-gray with a broad white posterior margin.

The fish bears a variety of names in different parts of its range, the commonest being *pla sawai*, sometimes modified into *pla sawai kluey* in the Bangkok region. A name used in the Paknampo section, including Bung Borapet, is *pla ai dong*, this designation being properly reserved for the immature fish, which are called *pla sawai* when adult. In the Pasak River a name in use is *pla sangkawad;* and Hora (1923b), on information received from Dr. Malcolm Smith, noted the name *pla sangkawart khao* for a Bangkok specimen.

PANGASIUS TAENIURUS Fowler

Pangasius taeniura Fowler, 1935a, p. 98, fig. 19 (Bangkok).

Described from 2 specimens, 8.5 and 8.3 cm. long, collected at Bangkok in 1934, this species has been based on the teeth characters indicated in the key, moderately developed barbels with the maxillary and mandibulary of nearly equal length, 28 or 29 rays in the anal fin, and a broad, dark longitudinal band in each caudal lobe.

PANGASIUS AEQUILABIALIS Fowler

Pangasius aequilabialis Fowler, 1937, p. 140, figs. 20–23 (Bangkok).

Known from four specimens 9.8 to 13.8 cm. long from Bangkok, this species may be recognized by a combination of structural characters and a unique color feature. The vomero-palatine teeth are in 4 separate rounded patches forming an arch or crescent; the gill rakers are numerous (about 40 on the first arch); both the maxillary and mandibulary barbels are well developed, longer than the head, and the maxillary extend to the middle of the pectoral fins or to the ventrals; the branched anal rays number 29 to 30; and there is on the opercle a large rounded dark blotch.

PANGASIUS MACRONEMUS Bleeker

Pangasius macronema Bleeker, 1851 (26), p. 11 (Bandjermassing, Borneo); 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—Sauvage, 1881, p. 162 (Siam, Grand Lakes of Cambodia).—Fowler, 1935a, p. 98, fig. 17 (Bangkok).

The known range in Thailand covers the Menam Chao from below Bangkok to Paknampo, the Menam Sak below the barrage at Dha Luang, the Menam Lopburi at Lopburi, and the lower Menam Nan. A specimen obtained by Deignan from a fisherman in the gorge of the Meping on December 24, 1935, is interesting as being one of the very few fishes known from the Meping rapids. Several specimens in the British Museum were gifts from the Siamese Museum many years ago.

In Thailand this is a rather small species. The largest specimens have been 21.5 cm. long.

Local vernacular names borne by this species are *pla sangkawad* and *pla ai dong*, used by fishermen on the Pasak River.

PANGASIUS SIAMENSIS Steindachner

Pangasius siamensis Steindachner, 1879, p. 393 (Menam Chao Phya at Bangkok).—Sauvage, 1881, p. 162 (Siam); 1883b, p. 154 (Menam Chao Phyá).—Hora, 1923b, p. 167 (Bangkok).—Fowler, 1934a, p. 88 (Bangkok); 1935a, p. 98, fig. 16 (Bangkok); 1937, p. 138 (Bangkok, Mepoon).

This species is apparently peculiar to the basin of the Menam Chao Phya in Thailand. It was described by Steindachner from a specimen 25 to 26 cm. long from the Menam Chao Phya. Hora (1923b) had two young specimens from Bangkok. Fowler (1934a, 1935, 1937) reported numerous specimens from Bangkok and one from Mepoon. Specimens were collected by the writer at Paknam, near the mouth of the Menam Chao Phya; at Pakret on the same river above Bangkok; and in the Pasak at the irrigation barrage at Dha Luang.

The relations of this species are closest to *P. macronemus*, as indicated in the key. Steindachner wrote:

> In the length of the maxillary barbels this species is nearest to *Pangasius macronema* (from Siam, Borneo, and Java), in the form of the four patches of palatine teeth to *Pang. micronema* Blkr., in the size of eyes and the shape of the head to *Pang. rios* Blkr. But in my opinion it is not very probable that on examination of a larger number of specimens the identity of *P. siamensis* with *P. macronema* would be found.

The usual vernacular name for this fish is *pla sangkawad*, sometimes modified to *pla sangkawad leuang*.

PANGASIUS LONGIBARBIS Fowler

Pangasius longibarbis Fowler, 1934a, p. 87, fig. 27 (Chiengsen).

Described from 2 specimens, 12 and 5.6 cm. long, taken in the Mekong at Chiengsen, Northern Thailand, in February 1933, this species is known from no other locality but may, of course, be looked for along adjacent stretches of the Mekong. Its most salient features are the length of the maxillary barbels, which reach beyond the origin of the anal fin, and the long anal fin, which has 39 to 41 branched rays. The vomero-palatine teeth, which in this genus are so important for specific identification, are undescribed as to shape and relations of bands. There are said to be "narrow villiform bands on vomer," and there is no mention of palatine teeth. The position of the species is therefore uncertain, but as the describer states that it is related to *Pangasius siamensis* it has been provisionally placed in the foregoing key in the section characterized by vomero-palatine teeth in 4 separate patches.

Genus PTEROPANGASIUS Fowler

Pteropangasius Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 89, p. 142, 1937. (Type, *Pangasius cultratus* H. M. Smith.)

PTEROPANGASIUS CULTRATUS (H. M. Smith)

Pangasius cultratus Smith, 1931a, p. 25 (Peninsular and Central Siam).
Pteropangasius cultratus Fowler, 1937, p. 144, figs. 31–33 (Mepoon); 1939, p. 43 (Krabi).

The type and paratype of this species came from the Tapi River near Bandon, Peninsular Thailand, in September 1923. Additional specimens available at the time the species was described were from the Sikuk and Chao Phya Rivers, Central Thailand, in November 1923, and September 1924. The fish was next observed in August 1930, when one was collected in the Meklong, at Rajaburi, Central region. Seven specimens from Mepoon, Central district, in 1936 are referred to by Fowler.

The type, 26 cm. long, is the largest example obtained.

In view of the possession of a median keel extending the entire length of the abdominal cavity, combined with greatly compressed body, short maxillary barbels, and very numerous anal rays, this specimen has been made the type of a new genus, *Pteropangasius*, by Fowler. It may be pointed out that the description and figure of the dentition given by Fowler do not agree with that of the type and paratype in the U. S. National Museum as regards the vomeropalatine teeth. The original description indicated two horizontal ovate patches of vomerine teeth with an oblique patch of palatine teeth on each side, the whole dental mass forming a crescent. Fowler shows two rounded patches of vomerine teeth and no palatines. As the specimens in the two collections are otherwise in agreement, it may be assumed that in this form, as in *Pangasius*, the dentition is subject to variation.

Genus HELICOPHAGUS Bleeker

Helicophagus BLEEKER (174), Act. Soc. Indo-Neërl. (Sumatra), vol. 3, p. 45, 1858. (Type, *Helicophagus typus* Bleeker.)

The helicophagids are very closely related to the pangasiids. Both have 4 barbels, a maxillary pair and a mandibulary pair (which latter may be rudimentary or altogether absent in large examples of some species). The important point of difference is that whereas the pangasiids have both vomerine and palatine teeth, the helicophagids always lack palatine teeth. The front border of the snout is pierced by the anterior nostrils, which are directed forward or upward, while the posterior nostrils are midway between the anterior ones and the eyes.

The genus *Helicophagus* is well named. Of the various specimens examined by me at different time and places in Thailand, all had entire shells of small univalve mollusks in their stomachs. The two known species from Thailand may be differentiated as follows:

1*a*. Anal rays 30; maxillary barbel not extending beyond preopercle; mandibulary barbel not extending beyond eye; vomerine teeth in 2 straight widely separated bands-- hypophthalmus

1*b*. Anal rays 37 to 38; maxillary barbel extending beyond base of pectoral fin or not so far; mandibulary barbel reaching base of pectoral fin or not so far; vomerine teeth in 2 small oblique widely separated patches. waandersii

HELICOPHAGUS HYPOPHTHALMUS Sauvage

Helicophagus hypophthalmus SAUVAGE, 1878b, p. 235 (Laos, Indo-China); 1881, p. 170, pl. 7, fig. 1 (Laos, Mekong; Grand Lakes of Cambodia, Indo-China).

Pangasius hypophthalmus HORA, 1923b, p. 166 (Bangkok).—FOWLER, 1934a, p. 88 (Bangkok).

Although both Hora (1923b) and Fowler (1934a) placed Sauvage's *Helicophagus hypophthalmus* in the genus *Pangasius*, there is nothing in Sauvage's description to indicate that his species, of which he had specimens from Laos, Grand Lakes of Cambodia, and the Mekong, is not a *Helicophagus*. A character adopted by Bleeker and by Weber and de Beaufort to separate *Helicophagus* from *Pangasius*, namely, the presence in the latter of palatine teeth, clearly excludes *H. hypophthalmus* from *Pangasius*. Sauvage's account is very definite on this point, and may properly be read in conjunction with his adjoining account of new species of *Pangasius*, in which he distinctly describes the palatine as well as the vomerine teeth. Hora has apparently misread Sauvage, who refers to the variation in the vomerine teeth dependent on age, and the entire absence of vomerine teeth in a specimen 75 cm. long and the complete disappearance of vomerine as well as maxillary teeth in specimens a meter long. The absence of palatine teeth in a specimen of *H. hypophthalmus*, 14.5 cm. long, from Bangkok, was suggested by Hora as explainable by Sauvage's statement, which may properly be quoted in full:

> In this species the length of the barbels and the arrangement of the vomerine teeth vary much with age, a fact interesting to note, since one knows that these two characters, which from this very reason have no value, have been regarded as specific by the generality of ichthyologists.
>
> In an individual of middle age (60 cm. long), the maxillary barbel extends to the edge of the preopercle; the mental barbel, a fourth as long as the head, reaches the level of the anterior edge of the orbit. The vomerine teeth are disposed in two very straight bands separated from each other by a space equal to their length.
>
> The barbels are a little shorter in an individual 65 cm. long; the barbels are shortened further in an example of 75 cm., in which the maxillary barbel reaches only to the level of the center of the eye and has the same length as the mental barbel. The vomerine teeth are absent.
>
> The maxillary teeth, as well as the teeth of the vomer, disappear at the size of 1 meter; there is no mental barbel, the maxillary barbel is only 1.5 cm. long.

HELICOPHAGUS WAANDERSII Bleeker

Helicophagus waandersii BLEEKER, 1858 (189a), p. 175 (Palembang, Sumatra).
Helicophagus waandersi HORA, 1937d, p. 236 (Siam).

As far as collected specimens indicate, this fish of the Sumatran rivers is confined in Thailand to the basin of the Menam Chao Phya. It is common at times in the Bangkam River at Lopburi, in the Chao Chet River, and in parts of the Chao Phya proper. A specimen from the Menam Chao Phya is in the British Museum.

An interesting record for this species was the capture of a specimen 18 cm. long, in a trap in the Gulf of Siam far off the mouth of the Menam Chao Phya, August 12, 1923. A great volume of fresh water was at that time pouring out of the large rivers of Central Thailand, and the salinity of the upper gulf was materially reduced.

In Sumatra a length of 34 cm. is reported. In Thailand the largest specimen, taken at Nakon Sawan January 5, 1925, was 31.5 cm. long.

The fish makes a grunting sound, noticed especially when being taken into one's hand from out of the water. In allusion to the shape of the head, it is given the name *pla nu* (*nu*, mouse) by Thai fishermen, this term being used also as a suffix to names borne by various species of *Pangasius*.

Genus LAIDES Jordan

Laides Jordan, Genera of fishes, pt. 3, p. 293, 1919. (Type, *Pangasius hexanema* Bleeker.)

In establishing a genus to accommodate the single known species, Bleeker in 1858 gave it the Sundanese name of *Lais*, by which the fish was known for many years. This name was preoccupied in tunicates (Gistel, 1849) and Jordan in 1919 substituted the new name *Laides*.

LAIDES HEXANEMA (Bleeker)

Pangasius hexanema Bleeker, 1852 (67), p. 588 (Palembang, Batavia, Sumatra).
Lais hexanema Smith, 1931d, p. 179 (Nakon Nayok River).

Previously known only from Java, Borneo, Sumatra, and Malacca, this fish has been found to be of wide distribution in Thailand but apparently is very uncommon. It was added to the local fauna in 1929 when a specimen 12.5 cm. long was collected by the writer at Pong, on the Pong River, a tributary of the Menam Mun in Eastern Thailand. A second specimen 13 cm. long was taken by a Boy Scout in the Nakon Nayok River in 1930. The third and only other known specimen came from the rapids of the Meping in Northern Thailand in December 1935; it is 12.5 cm. long and was obtained by H. G. Deignan from a fisherman.

This is an easily recognized catfish. There are 4 large, flat barbels on the lower jaw and 2 long, ribbonlike maxillary barbels which extend to the ventral fins or even beyond the first third of the anal fin; the posterior nostrils are wide transverse slits on the upper surface of the snout; there are no palatine teeth, and the vomerine teeth are in two distinct transverse patches.

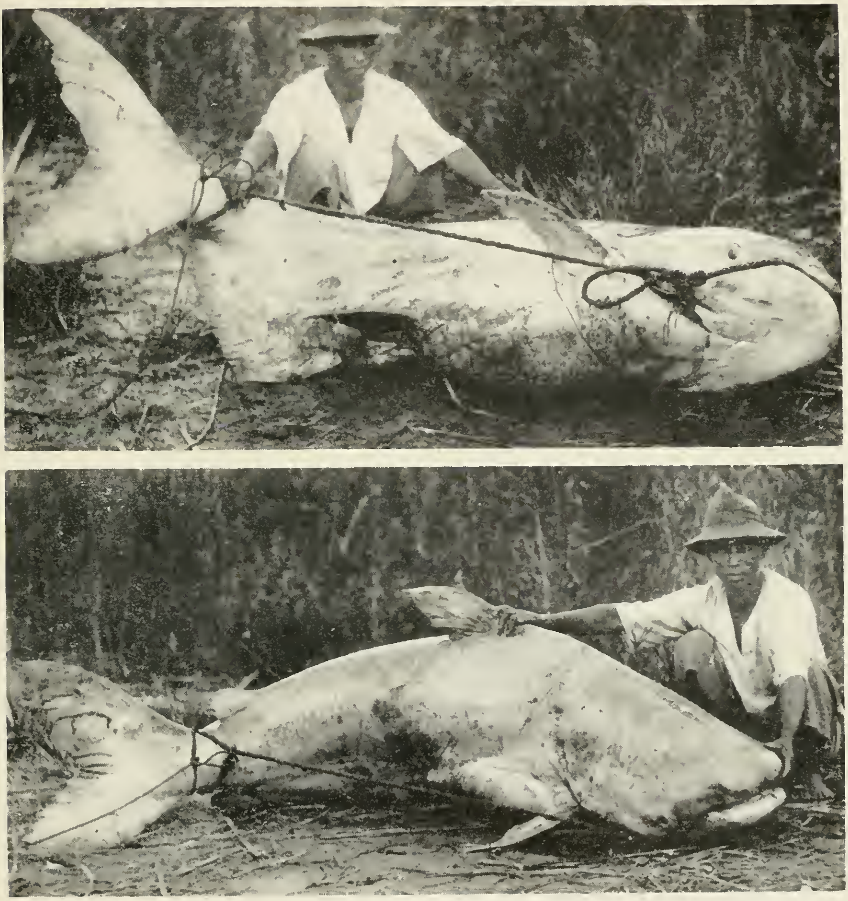
On the Pong River this fish has the distinctive name of *pla yorn*, On the Nakon Nayok it is apparently not distinguished from other small pangasiids and is called *pla sangkawart* or *sangkawad*.

Genus PANGASIANODON Chevey

Pangasianodon Chevey, Bull. Soc. Zool. France, vol. 55, pp. 536–542, fig. 1, pl. 1, 1930. (Type, *Pangasianodon gigas* Chevey.)

In appraising the special features on which the genus *Pangasianodon* is based, one may note that no examples of small or even medium size have ever been described. Chevey did not designate a type specimen; the only example of which he gave the length was one of almost 2 meters, which he saw in August 1930. The detailed measurements that accompany his description of *P. gigas* were taken from a model of a fish, 2.5 meters long, in the Economic Museum of Cambodia, which the present writer has examined.

In view of the well-established fact that in certain species of *Pangasius* the teeth may disappear with age, the question naturally arises whether in *Pangasianodon* the absence of teeth may not be simply an



PANGASIANODON GIGAS CHEVEY

Courtesy of the American Museum of Natural History.

age character and whether teeth may not exist in examples of, say, half a meter length.

The absence of mandibulary barbels might likewise be associated with excessive growth or great age. Chevey himself raised the question whether minute barbels may not perhaps exist in the young and be by degrees overwhelmed in the enormous fatty layer that develops on the jaw.

From the foregoing it would seem that the final determination of the status of *Pangasianodon* must await the examination of small individuals with special reference to their possible possession of teeth and mandibulary barbels.

PANGASIANODON GIGAS Chevey

PLATE 7

Pangasianodon gigas CHEVEY, 1930, p. 536, figs. 1, 2 (Mekong basin).

In Thai territory this fish occurs and is caught throughout the Mekong where it forms the international boundary, and it also enters the major streams tributary to the Mekong in Eastern Thailand, notably the Songkram, although in only limited numbers. It has a range of several thousand miles in the Mekong, coming at various times in its migratory movements under the jurisdiction of French Indo-China, Thailand, Burma, and China. There is no evidence that it ever enters the sea, and Chevey stated that in the protracted trawling done by the *de Lanessan* in the mouths of the Mekong and the Bassac this fish has never been taken.

During the period of flood water the fish remains in the lower Mekong and is caught in the Pnom-Penh area, a favorite resort and place of capture being the Quatre-Bras, near the lower end of the Tonle Sap in Cambodia. After the end of the rainy season and the subsidence of the flood water, the fish begins a well-marked upstream migration apparently for spawning purposes. In February the fish reaches Luang Prabang, in Laos, and there formerly gave rise to an extensive fishery. The fish pushes its way farther upstream, and is known from Chiengsen, Thailand, opposite the Shan States, and apparently traverses the entire length of the Shan States and enters the Chinese province of Yunnan. According to Pavie (1904) the fish spawns in Lake Tali, which, according to a special communication from the National Geographic Society, of Washington, D. C., is just east of the town of Tali in Yunnan Province, is about 30 miles long and 3 to 7 miles wide, and is connected with the Mekong by the Yangpi River.

At Luang Prabang the fish on its downstream movement after the spawning season used to be intercepted by nets until June (Pavie, 1904).

Whatever may be the dental equipment and the food and feeding habits of the young and half-grown fish, it is fully established that the adult fish is entirely devoid of teeth and is a strict vegetarian. Visual and tactile examination of fish over 2 meters long in Cambodia and Laos prior to and during their upstream migration disclosed to the writer the absence of even a vestige of teeth in the jaws and on the vomer and palatine bones; and all the information available, drawn chiefly from Cambodian, Laos, and Siamese fishermen and from French and Thai officials along the Mekong, supplemented by limited personal observation, indicates that the food of the fish consists largely, perhaps exclusively, of algae cropped from stones on the bottom and sides of the river. The frequent presence of stones, up to the size of a man's fist, in the stomach and intestine of the fish is easily accounted for by the supposition that they have been inadvertently swallowed in efforts to detach the algae.

It is stated by Pavie and others that when the fish is in Cambodian waters, prior to the upstream migration, its flesh is very fat and for that reason is not highly regarded for human food. By the time the fish reaches Luang Prabang it has lost much of its fatness and is in good repute as a food, bringing a high price in the markets. Coincident with the decrease of fat in the tissues there is enlargement of the sex glands, and the writer has seen salted ovaries over 60 cm. long that had been taken from fish caught at Luang Prabang and preserved for a select Thai trade.

For a fish of such extraordinary size, striking habits, economic importance, and ethnological and historical interest, it is surprising that so little is definitely known regarding it. There has never been a real study of its habits, migration, spawning, growth, etc. That the study is much needed is shown by the lack of basic information regarding the fish and by some of the statements that have appeared in print illustrative of the views of fishermen and other persons. Thus, the Laos people in the French Province of Laos believe that only the females wander freely over the river and imagine that the males, with golden scales, await their arrival in Lake Tali, which they never leave.[6] A communication to the Journal of the Natural History Society of Siam (Duke, 1921) implies that the creature nourishes its young with milk, a view that has been expressed orally to me by Thai officials who visited the upper Mekong and saw the fish there more than half a century ago. The scanty literature and the writer's interviews with fishermen and local officials concerned with activities along the Mekong have afforded no references to fish less than a meter long.

The celebrated giant catfish of the basin of the Mekong remained without a scientific name until 1930. Various conjectures as to its possible identity had been made from time to time; thus, Vaillant (1904), having before him photographs of the fish, wrote "the genus does not seem doubtful, it is a *Pangasius*," but he did not venture a specific determination. The first definite action to this end was taken by Dr. Pierre Chevey, who had seen many fresh examples of the fish in the market at Pnom-Penh, Cambodia, and who decided that the fish represented a new genus and a new species, for which he proposed the name *Pangasianodon gigas*.

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[6] Pavie (1904) quoted by Chevey (1930).

The separation of *Pangasianodon* from *Pangasius*, which course Chevey was apparently justified in taking on the basis of the material available, was prompted by the discovery that *P. gigas* has no teeth in the jaws or on the vomer and palatines, has only a single pair of barbels (maxillary), and has the eye placed entirely below the level of the angle of the mouth, while in *Pangasius* there are bands of teeth in the jaws and on the vomer and palatines, a second pair of barbels (mandibulary), and the eye either above or opposite the level of the angle of the mouth.

The vernacular name for this fish is *trey reach* (royal fish) among the Cambodians. By the Thai and Laos it is called *pla bük* (huge fish).

The zoological interest and economic value attained by this species would strongly recommend a joint investigation by Indo-China and Thailand with a view to adopting measures that may prevent its further decline, if they do not restore its former abundance.

Family AMBLYCIPITIDAE

These fishes, among the most diminutive of the local siluroids, may properly constitute a separate family to include only the genus *Amblyceps*, as advocated by Hora (1936a). *Amblyceps* has sometimes (Jordan, 1923) been included with *Akysis* and other genera to form the family Akysidae, but the characters shown in the key, with others not therein indicated, seem to justify the separation of the two families.

Genus AMBLYCEPS Blyth

Amblyceps Blyth, Journ. Asiat. Soc. Bengal, vol. 27, p. 281, 1858. (Type, *Amblyceps caecutiens* Blyth.)

AMBLYCEPS MANGOIS (Hamilton)

Pimelodus mangois Hamilton, 1822, pp. 199, 379 (Behar).

Amblyceps mangois Smith, 1931d, p. 180 (Eastern, Peninsular, and Southeastern Siam).—Hora, 1933, p. 617 (Pakjong).—Hora and Mukerji, 1934, p. 125 (Pakjong, Nakon Sritamarat, Chantabun Estuary).—Fowler, 1939, p. 58 (Trang).

Previously known only from India and Burma, this species was added to the known fauna of Thailand in 1925 by the taking of specimens in a small mountain brook tributary to the Menam Mun near Pakjong in the Eastern region. The fish was collected in the same locality in 1927 and 1929, and in the Peninsula and the Southeastern district in 1928.

The maximum length is about 12 cm.

The fish bites viciously, and can live out of water for a long time.

The most noteworthy account has been given by Hora (1933). In a discussion of this highly specialized diminutive catfish of uncertain ancestry, Hora says: "The most remarkable structure of *Amblyceps* is the development of the fold of skin in front of the pectoral fin * * *. This is no doubt a special acquisition for respiration in the fast currents characteristic of its natural haunts."

In his general account of *Amblyceps*, Hora (1933) devoted some space to a notice of three Thailand specimens sent to the Indian Museum by H. M. Smith, and quotes from a letter from the latter as follows:

> These [specimens] are from Pak Jong, a mountain district in east-central Siam, March 12, 1927. Other localities represented in our collection are Nakon Sritamarat, Peninsular Siam, and Chantabun Estuary, south-east Siam. The last locality is peculiar in that the water is brackish, but the single specimen could easily have come down from hill streams in the Chantabun basin, where, however, the species has not yet been collected.

In the course of a paper on fishes from the Southern Shan States, Hora and Mukerji (1934) refer to 19 other Thai specimens sent for examination. Their conclusion is that without further study of a large amount of material from Burma and Thailand "it is difficult to separate the Thailand form as a distinct species, variety, or even as a local race."

The vernacular name at Pakjong is *pla dak*.

Family BAGRIDAE

The bagrid catfishes in Thailand fall into four rather strongly differentiated genera. The outstanding family characters are: 4 pairs of barbels (nasal, maxillary, mandibulary, and mental), of which the maxillary pair may in some species extend to or on the caudal fin; posterior nostrils well separated from the anterior and having a barbel on their margin; jaw teeth villiform in bands, vomeropalatine teeth in a single oval patch or in a curved band; gill membranes free from the isthmus and either united to or separated from each other; marked development of the adipose fin, which in some species may be nearly half the standard length of the fish; dorsal fin arising in advance of the ventrals, with a pungent spine serrated or smooth on its posterior side and with 6 or 7 branched rays; and caudal fin well developed and forked. Other characters, which will differentiate the genera, are as follows:

1*a*. Eyes subcutaneous; gill membranes various.
  2*a*. Gill membranes united to each other; vomerine teeth in a curved band or an elliptical patch; dorsal spine with teeth on its posterior side directed upward -- **Bagroides**

2*b*. Gill membranes almost totally separated from each other and from the isthmus; vomerine teeth in a curved band; dorsal spine with its posterior side smooth or with teeth directed downward_______________ Leiocassis

1*b*. Eyes not subcutaneous; gill membranes free from isthmus and for most part from each other; vomerine teeth in a curved continuous band.

3*a*. Dorsal fin of moderate height, its spine serrated on its posterior side_Mystus

3*b*. Dorsal fin very high, its spine long, slender, and unserrated on its posterior side____ Heterobagrus

Genus BAGROIDES Bleeker

Bagroides Bleeker (45), Nat. Tijdschr. Nederl-Indië, vol. 2, p. 204, 1851. (Type, *Bagroides melapterus* Bleeker.)

In Thailand these medium-sized river fishes are of very restricted range and are uncommon or rare. They may be rather easily recognized by their small head, conical snout, small mouth, long adipose fin, short pectoral fin with a strong serrated spine, and striking coloration: Yellow or brown ground color with large black blotches or cross bands on head and body.

The characters that separate the species are as follows:

1*a*. Vomerine teeth in single roundish patch; adipose fin free behind, its base 1 to 1.5 times length of head; dorsal, anal, ventral, and pectoral fins black distally____ melapterus

1*b*. Vomerine teeth in a single semilunar patch; adipose fin with no free posterior edge, its base twice length of head or longer.

2*a*. Dorsal and pectoral spines about length of head; width of mouth about equal to diameter of eye; dorsal, anal, ventral, and pectoral fins conspicuously blackish distally______________________________ macropterus

2*b*. Dorsal spine much longer than head and much longer than pectoral spines; width of mouth less than twice diameter of eye; dorsal, anal, ventral, and pectoral fins usually brown, sometimes blackish distally__ macracanthus

BAGROIDES MELAPTERUS Bleeker

Bagroides melapterus Bleeker, 1851 (45), p. 204 (Bandjermassing, Borneo).—Weber and de Beaufort, 1913, vol. 2, p. 348 (Siam).

Bagroides melanopterus Sauvage, 1883b, p. 154 (Menam Chao Phya).

No one but Sauvage has reported directly on the occurrence of this species in Thailand. He listed it merely as among species represented in a collection obtained in the Menam Nan by Dr. Harmand. The reference of Weber and de Beaufort is probably based on Sauvage's record. The fish, reaching a length of 34 cm., is otherwise known only from Sumatra and Borneo.

BAGROIDES MACROPTERUS Bleeker

Bagroides macropterus Bleeker, 1853 (86), p. 515 (Moara, Sumatra).—Sauvage, 1881, p. 161 (Siam and Sumatra); 1883b, p. 154 (Menam Nan).—Weber and de Beaufort, 1913, vol. 2, p. 349 (Siam).

Pseudobagrichthys macropterus Bleeker, 1865 (347), p. 34 (Siam); 1865 (356) p. 175 (Siam).

Observations thus far made indicate that in Thailand this fish has occurred in recent years only in the lower Menam Chao Phya, the

Menam Nakon Nayok, and the Menam Bangpakong. Reporting on a collection made in the Menam Nan by Dr. Harmand, Sauvage (1883b) gave merely the name of this fish. In July 1923, 40 years later, the writer collected in the Bangpakong two specimens that were 17.3 and 18.6 cm. long, and 5 years later, in June, he found another fish, 17 cm. long, in the Bangpakong and one, 23 cm. long, in the Nakon Nayok, a branch of the Bangpakong. In August 1929 a Boy Scout collected a fish, 14 cm. long, from the Nakon Nayok. The list of known specimens is completed by mentioning a specimen, 24 cm. long, without data, received by the Siamese Bureau of Fisheries in 1928 from effects of the old Siamese Museum, which long ago ceased to function as a natural history depository.

Owing to its peculiar shape and coloration, this fish is always distinguished by local fishermen and given special names, including *pla kayeng hin* (*hin*, rock or stone), *pla kayeng nu* (*nu*, mouse), *pla kayeng wang* (*wang*, swamp or marsh), and *pla kot mu.*

BAGROIDES MACRACANTHUS Bleeker

Bagroides macracanthus Bleeker, 1854 (106), p. 88 (Sumatra).—Sauvage, 1881, p. 161 (Siam).

Pseudobagrichthys macracanthus Bleeker, 1865 (347), p. 34 (Siam).—Bleeker, 1865 (356), p. 175 (Siam).

This species seems to be peculiar to Sumatra and Thailand. There are very few Thai records, and the fish must be considered very rare. A specimen, 22 cm. long, from the fishery at Koh Yai, on the Menam Chao Phya above Bangkok, obtained in January 1926, agreed with Bleeker's description with the exception that the dorsal, anal, ventral, and pectoral fins were more or less black and the caudal was white, in this respect suggesting *B. macropterus.*

A length of 24 cm. is attained in Sumatra.

The local fishermen applied the name *pla kayeng bai kao.* A specimen 12.6 cm. long was collected by a Boy Scout in the Nakon Nayok in January 1930. The Scout gave the local vernacular name as *pla kayeng wang*, applied also to *B. macropterus* in the same region.

Genus LEIOCASSIS Bleeker

Leiocassis Bleeker (189), Act. Soc. Sci. Indo-Neërl. (Siluri), vol. 4, p. 139, 1857–58. (Type, *Leiocassis micropogon* Bleeker.)

The leiocassids are small fishes of fresh-water streams with strongly contrasted (mostly black and white) coloration. Their center of abundance is Java, Borneo, and Sumatra, with their range extending to Malaya, Thailand, and Cambodia.

Leiocassis leiacanthus Weber and de Beaufort, previously known only from Sumatra, has been reported by Herre and Myers from Johore and Perak; and *Leiocassis micropogon* (Bleeker), of Sumatra and Borneo, is recorded from Malacca. Both of these species may be found eventually in Peninsular Siam.

The three species from Thailand may be differentiated as follows:

1*a*. Depth of body 3.75 to 4.25 in standard length; barbels relatively short, the maxillary reaching to or beyond posterior edge of eyes but not to gill openings.
  2*a*. Head long, its width about 0.6 its length; dark brown cross bands with light interspaces; a continuous submarginal black or dark cross band on caudal fin-- poecilopterus
  2*b*. Head shorter, its width about 0.8 its length; dark brown or black cross bands with white interspaces; each caudal lobe with or without a black subterminal spot------------------------------------- siamensis
1*b*. Depth of body 4.6 to 6 in standard length; barbels long, the maxillary and mandibulary reaching beyond base of pectorals; head short, its width about 0.8 its length; light brown, with irregular dark markings------ stenomus

LEIOCASSIS POECILOPTERUS (Cuvier and Valenciennes)

Bagrus poecilopterus Cuvier and Valenciennes, 1839, vol. 14, p. 431 (Java).
Liocassis poecilopterus Peters, 1868, p. 272 (Siam).
Leiocassis poecilopterus Weber and de Beaufort, 1913, vol. 2, p. 356 (Siam).

The assignment of this species to Thailand is made on the authority of Peters. No examples have recently been met with, although there is no reason why the fish may not occur in local waters, as do numerous other species known otherwise from Java, Borneo, and Sumatra.

LEIOCASSIS SIAMENSIS Regan

Figure 83

Liocassis siamensis Regan, 1913, p. 550 (Bangpakong River); Hora, 1923b, p. 172 (Menam Chao Phya at Nontaburi).
?*Leiocassis bicolor* Fowler, 1934a, p. 95, fig. 43 (Chiengmai, Bua Yai).
?*Leiocassis albicollaris* Fowler, 1934b, p. 337, fig. 2 (Bangkok); 1937, p. 150, figs. 54–63 (Bangkok, Pitsanulok, Mepoon).
Leiocassis albicollis Fowler, 1939, p. 58 (Trang).

This fish is common and widely distributed in Thailand. It has been collected by the present writer in the Menam Chao Phya at numerous places throughout its course to its head at Paknampo and in many collateral streams (Chao Chet, Sikuk, and others), in the Mewang at Lampang, in the Meklong at Rajaburi and Potaram, in the Menam Mun at Pakjong and Ta Chang, in the Menam Tapi and the Menam Tadi in Peninsular Thailand, and in brackish water of the Chantabun River. In January 1926 I obtained specimens at Kompong Chnang, on an outlet of Tonle Sap, the great inland sea of Cambodia.

The Deignan collection contains specimens obtained in April and June 1935 in the Meping at Chiengmai and in the Mekhan and Mechem, tributaries of the Meping.

Among a lot of these fishes caught in the Chao Chet River November 26, 1923, was one, 11.5 cm. long, with very large ovaries. The largest examples met with have been 17 cm. long, taken during November and December at Paknampo. Fishes up to 15 cm. long are common.

The general color of this species is white or pale yellow with black or dark brown cross bands wider than the interspaces. The bands vary in shape, size, and position; usually there is a band involving the head, another from the nape and subdorsal region to the pectoral and ventral fins, another from the adipose fin to the anal, and always one across the caudal peduncle at the base of the caudal fin. The individual bands may be interrupted or variegated by light spots or stripes. The bands always extend on the dorsal, adipose, anal, ventral, and pectoral fins, which may be entirely black or dark brown or particolored in various patterns.

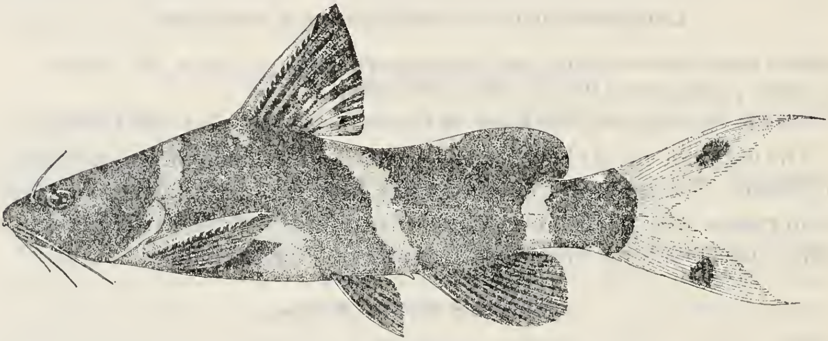

FIGURE 83.—*Leiocassis siamensis* Regan. Drawn by Luang Masya; courtesy of the Thailand Government.

Leiocassis siamensis was described by Regan from a single specimen, 9 cm. long, taken in the Bangpakong River and sent to the British Museum by the Siamese Museum in 1897. From its nearest known relative, *L. poecilopterus*, it was separated chiefly by a difference in the ratio between the length and width of the head, the head being significantly wider in the present species. Other differences, as brought out in Regan's description and in specimens referable to *L. siamensis* from the type locality and numerous other places, are more slender body, greater length of the maxillary barbels, absence of a posteromedian process in the band of vomeropalatine teeth, slightly more slender caudal peduncle, and slightly longer dorsal spine, most or all of which features might depend on age, size, or individual variation. A color difference is that whereas *L. siamensis* has a dark brown or black spot or bar on each caudal lobe, the colored figure of *L. poecilopterus* given by Bleeker (1862 (301), vol. 2) shows a continuous submarginal dark band extending from one lobe to the other.

Specimens from the Menam Chao Phya were reported by Hora (1923b) as in fairly close agreement with Regan's type; and a specimen from the upper waters of the Menam Mun sent to Dr. L. F. de Beaufort was regarded by him as representing *L. siamensis.*

It has been possible to separate *L. bicolor* Fowler, described from specimens 4.1 to 9.7 cm. long, from fishes that are considered representing normal variation in *L. siamensis*, of which species Fowler makes no mention. The location of the nasal barbel over the eye, as in Fowler's figure, would be a significant character, but as the text makes no reference to this unusual feature it is assumed the figure may be defective. Similarly, *L. albicollaris* Fowler, described from a single specimen, 11.4 cm. long, is believed to be *L. bicolor* and, therefore, *L. siamensis.* The species, as originally described, was differentiated from *L. bicolor* by having 16 as against 14 anal rays, larger adipose fin, dorsal spine with about a dozen retrorse serrae as against 6, 13 denticles on pectoral spine as against 9 or 10, and entirely white caudal fin and a pale nuchal collar. Examination of a large series of specimens of this type shows that there is, within narrow limits, considerable variation in the number of serrations on the dorsal and pectoral spines. Thus, in a lot of 10 fishes from the Meping, the well-developed dorsal serrae varied from 7 to 12 (average 9.6) and the pectoral serrae varied from 9 to 16 (average 14.5). The size of the adipose fin, with its base much longer than that of the anal and its origin separated from the dorsal base by a space only half the length of that base, would be a significant character, but these points disappear among the 10 figures showing variation in *L. albicollaris* (Fowler, 1937). The pale nuchal collar is not distinctive; and instead of a pale or white unmarked caudal fin, as called for by the description, 7 of the 10 figures of variation have black spots on the caudal lobes as in *L. bicolor.*

Vernacular names borne by this fish are *pla kayeng hin* and *pla kot hin.* The fish makes a croaking sound (*kot*), which may be quickly repeated a number of times; the sound is heard when the fish is free in the water and also after it is taken from the water.

LEIOCASSIS STENOMUS (Cuvier and Valenciennes)

FIGURE 84

Bagrus stenomus CUVIER and VALENCIENNES, 1839, vol. 14, p. 415 (Java).

The inclusion of this species in the present catalog is based on the taking of a specimen in the Chantabun River in Southeastern Thailand. The fish is otherwise known from Java, Borneo, Sumatra, and Malaya. The specimen in hand, 9.1 cm. long, obtained June 3, 1927, when caught was of a light brown color with irregular dark brown markings in large pattern on head and body, and a small rounded darker spot above the humeral process. The body is rather slender (depth 5.75 in standard length); the nasal barbels reach far beyond the eyes, both the maxillary and mandibular barbels extend behind the base of the pectorals, and the mental barbels reach the branchial openings; the dorsal fin is separated from the adipose fin by a space equal to the length of the adipose base, which exceeds the length of the anal fin; the caudal fin, deeply forked with upper lobe the longer, is more than 1.5 times the length of the head; the pectoral spine is longer than the dorsal spine and equal to the distance from the posterior nostril to the gill opening; the ventrals, somewhat more than 0.5 length of head, extend to a long, slender anal papilla.

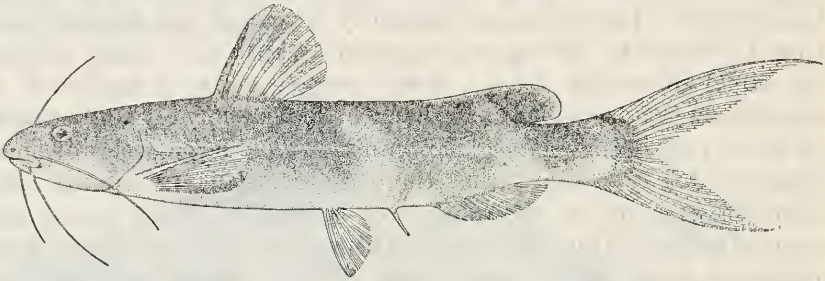

FIGURE 84.—*Leiocassis stenomus* (Cuvier and Valenciennes). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Genus MYSTUS Scopoli

Mystus SCOPOLI, Introductio ad historiam naturalem, p. 451, 1777. [We have not been able to determine with satisfaction the genotype of *Mystus* Scopoli. The situation is in need of study, and a separate paper would be required to clarify the nomenclature of *Mystus* and its various uses.—L.P.S.]

The fishes now placed in the genus *Mystus* have borne many generic names. The earliest available name is *Mystus*, first used by Gronow in 1763 and validated by Scopoli in 1777. For many years the fishes were called *Macrones* (Duméril, 1856), although that name was preoccupied in entomology (1841). *Aoria*, proposed by Jordan (1919, p. 341) as a substitute for *Macrones*, had some usage, although if *Mystus* were not acceptable the Bleekerian names *Hemibagrus*, *Hypselobagrus*, and *Aspidobagrus* were available.

The mystid catfishes are numerous as to species and individuals in the fresh waters (rivers, canals, lakes) of Thailand. Most of them are small; one species reaches a length of more than 60 cm. in this country. All are eaten and some of them appear regularly in the markets of Bangkok and other large communities.

The usual vernacular generic name for these fishes throughout Thailand is *pla kayeng*, meaning ugly or repulsive fish. Various qualifying names are used for the different species. The word *kayeng* is often shortened to *yeng*.

The numerous local species may be distinguished chiefly by the length of the adipose and anal fins, the length of the nasal and maxillary barbels, the degree of depression of the head, and the following characters:

1*a*. Base of adipose fin equal to or shorter than base of anal fin and not contiguous to base of dorsal fin.
  2*a*. Head conical or somewhat depressed or flattened; top of head rough or granulate.
    3*a*. Nasal barbels longer than head; maxillary barbels reaching caudal fin ---------- wolffii
    3*b*. Nasal barbels reaching well behind eye; maxillary barbels reaching to or beyond base of anal fin.
      4*a*. Back and sides uniform brown ---------- gulio
      4*b*. Back and sides marked by 5 to 7 narrow longitudinal black and white stripes, with a small black, white-edged humeral spot ----- vittatus
    3*c*. Nasal barbels shorter, extending on eye or very slightly beyond eye.
      5*a*. Maxillary barbels extending nearly or quite to base of anal fin; dorsal fin high, 1.5 times depth of body; occipital process long, slender, and reaching basal bone of dorsal spine ---------- nemurus
      5*b*. Maxillary barbels extending only to base of ventral fins; dorsal fin lower, its height about equal to depth of body; occipital process short, reaching half or less than half the distance to basal bone of dorsal spine ---------- planiceps
  2*b*. Head very broad and flat, top of head smooth; nasal barbels nearly reaching eye, maxillary barbels reaching dorsal fin or almost to adipose fin; upper and lower edges of caudal fin yellowish ---------- wyckii
1*b*. Base of adipose fin much longer than base of anal fin and contiguous to base of dorsal fin.
  6*a*. All barbels short; nasal barbels reaching eyes; maxillary barbels less than length of head; body with irregular dark crossbands ---------- havmölleri
  6*b*. All barbels long; nasal barbels reaching beyond eyes; maxillary barbels extending to base of anal fin or to or on caudal fin.
    7*a*. Median fontanelle long, extending to base of occipital process; head conical; general color grayish ---------- cavasius
    7*b*. Median fontanelle short, its posterior end far from base of occipital process, head somewhat flattened; general color brown, a dark spot at base of caudal, a round black spot behind head, bordered with white in young ---------- micracanthus

MYSTUS WOLFFII (Bleeker)

Bagrus wolffii Bleeker, 1851 (45), p. 205 (Bandjermassing, Borneo).
Hypselobagrus wolffi Bleeker, 1865 (356), p. 175 (Siam).—Sauvage, 1881, p. 161 (Siam).
Macrones wolffi von Martens, 1876, p. 400 (Siam).—Weber and de Beaufort, 1913, vol. 2, p. 340 (Siam).—Hora, 1923b, p. 171 (Nontaburi).
Mystus wolfii Fowler, 1934a, p. 95 (Chiengmai, Bangkok).
Mystus wolffii Fowler, 1935a, p. 104, fig. 29 (Bangkok); 1937, p. 148 (Bangkok, Tachin, Pitsanulok); 1939, p. 44 (Krabi).

With the exception of Malacca, this species is recorded only from Borneo, Sumatra, and Thailand.

The usual length of mature fish is 12 to 20 cm. The largest examples observed have been 30 cm. long.

It is essentially a fish of the lower courses of rivers. Specimens have been examined from the Patani River, the inner lake of the Tale Sap, the Tapi River near Bandon, the Tachin River near Tachalom, and various parts of the lower Chao Phya River. The only record of a fish far from the sea is that of Fowler (1934a) for a specimen 11 cm. long from the Meping at Chiengmai, Northern Thailand.

The fish sometimes enters salt water off the mouths of rivers and may be found there abundantly. Collections made for the Siamese Bureau of Fisheries contained specimens from the Gulf of Siam off the Banghia River in July, off the Tapi River in Bandon Bight in September, and off Pakpoon, Nakon Sritamarat, in October.

Thai fish conform generally with the description given by Weber and de Beaufort. In a number of specimens, 12.5 to 16.5 cm. long, however, the mandibulary barbels do not extend on the anal fin but fall considerably short of the anal origin.

In a fish 17.3 cm. long from the Gulf of Siam off Bandon the left maxillary barbel had been amputated at about its midlength and the right maxillary barbel was represented by a stump that reached only halfway to the eye; from the upper edge of this stump a new, very slender barbel had grown and extended beyond the eye.

The species shares with others of the genus the vernacular name *pla kayeng* or *pla yeng*. In the Province of Patani, with its large Malay population, the fish is called *ikan baon*, a name bestowed on *M. nemurus* in Sarawak (*ikan baung* in Sumatra).

MYSTUS GULIO (Hamilton)

Pimelodus gulio HAMILTON, 1822, p. 201, pl. 23, fig. 66 (Gangetic estuaries).

Macrones gulio VON MARTENS, 1876, p. 400 (Petchaburi) (identification doubtful).—HORA, 1923b, p. 171 (Menam Chao Phya at Nontaburi).

Mystus gulio FOWLER, 1934a, p. 95 (Bangkok); 1934b, p. 337 (Krat); 1939, p. 44 (Krabi).

A species of very wide distribution (India, Burma, Ceylon, Thailand, Malay Peninsula, Sumatra, Borneo, Java, Madoera), *M. gulio* abounds in the lower courses of the tidal rivers discharging into the Gulf of Siam, and doubtless occurs also on the western side of Peninsular Siam, although there are no definite records therefrom.

The fish reaches great abundance in the rivers debouching into the head of the Gulf of Siam, and has been collected also in the Patani River and in the gulf at Pakpoon, Peninsular Thailand, and at Chantabun and Krat, Southeastern Thailand. In the Menam Chao Phya the fish regularly ascends as far as Pakret. Young fish, up to 6 to 7 cm. long, go in immense, compact schools. In the Tachin and the canals connecting that river and the Menam Chao Phya, as well as in the canals extending eastward from the Menam Chao Phya, the fish is common.

In the East Indies this species reaches a length of nearly half a meter, but in Thailand 25 cm. seems to be about the maximum, and the usual length of mature specimens is 12 to 15 cm.

The usual vernacular name borne by this fish is *pla mang kong*. On part of the coast of Nakon Sritamarat, the name is *pla yeng nu* (*nu*, mouse).

MYSTUS VITTATUS (Bloch)

FIGURE 85

Silurus vittatus BLOCH, 1797, vol. 11, p. 40, pl. 371, fig. 2 (Tranquebar).

Hypselobagrus tengara BLEEKER, 1865 (356), p. 175 (Siam) (not *tengara* of Hamilton).

Macrones tengara PETERS, 1868, p. 271 (Siam).—VON MARTENS, 1876, p. 400 (Petchaburi).—KÁROLI, 1882, p. 178 (Siam) (identification doubtful).

Hypselobagrus tangara SAUVAGE, 1881, p. 161 (Siam) (identification doubtful).

Mystus vittatus SMITH, 1934b, p. 294 (Menam Chao Phya, Menam Bangpakong).—FOWLER, 1834a, p. 95 (Chiengmai); 1934b, p. 337 (Bangkok); 1935a, p. 104, fig. 28 (Bangkok); 1937, p. 146 (Bangkok, Tachin, Pitsanulok, Mepoon).

Mystus atrifasciatus FOWLER, 1937, p. 146, figs. 35, 36 (Pitsanulok, Mepoon).

This banded mystid, known from India, Burma, and Ceylon, is not very common in Thailand and has a limited distribution, according to the observations thus far made. It occurs sparingly in the Menam Chao Phya from Paknampo to Bangkok, in Bung Borapet, in the Meping at Chiengmai, in the Menam Bangpakong, and in the Meklong.

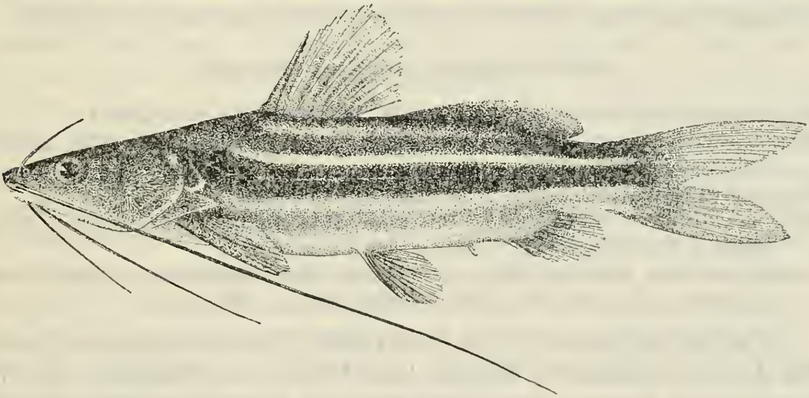

FIGURE 85.—*Mystus vittatus* (Bloch). Drawn by Luang Masya; courtesy of Thailand Government.

The largest Thai examples observed have been about 17 cm. long. A female, 13 cm. long, taken in a canal in Bangkok July 18, 1923, had large ovaries.

There is some variation in the intensity, number, and position of the dark longitudinal bands and also in the size of the adipose dorsal fin, which is normally of about the same length as the anal base. A specimen taken in a tributary of the Meklong near Rajaburi, characterized by a very much longer adipose fin that extended nearly to the dorsal, was submitted to Dr. Hora of the Indian Museum and pronounced by him as within the limits of variation of the species as observed in India.

M. atrifasciatus Fowler, described from a number of specimens 11 to 11.8 cm. long (Fowler, 1937) and "distinguished from *Mystus vittatus* chiefly by its much longer adipose fin," is believed by the writer to be covered by the normal variation in this feature as well as in the coloration in *M. vittatus.*

The recording of *Mystus tengara* (Hamilton) from Thailand by Bleeker and Károli was probably erroneous. The matter was discussed by the writer in 1934 (b). No specimens referable to *tengara* have been collected in Thailand in recent years. Regarding specimens from Thailand in the British Museum that had been regarded as *M. tengara*, Mr. J. R. Norman wrote: "We have three specimens from Bangkok (Fowler) and two larger ones labelled Siam (Prince Champorn) in the British Museum as *Macrones tengara.* I have examined these and find that they all agree with the description of *M. vittatus* as given by Day. Thus, it appears that the true *tengara* does not occur in Siam."

The fish is usually called *pla kayeng* but sometimes is given the distinguishing name of *pla kayeng kang lai* (*kang lai*, striped side).

MYSTUS NEMURUS (Cuvier and Valenciennes)

Bagrus nemurus Cuvier and Valenciennes, 1839, vol. 14, p. 423 (Java).

Hemibagrus nemurus Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—Sauvage, 1883b, p. 154 (Siam).

Hemibagrus hoevenii Bleeker, 1865 (356), p. 175 (Siam).

Macrones nemurus Weber and de Beaufort, 1913, vol. 2, p. 341 (Siam).—Hora, 1923b, p. 171 (Nontaburi); 1924a, p. 468 (Tale Sap).

Mystus nemurus Fowler, 1934a, p. 95 (Chiengmai, Chiengsen); 1937, p. 148, figs. 44–47 (Bangkok, Pitsanulok, Tachin, Mepoon, Kemarat).

Of wide distribution in the East Indies, this species occurs also on the Asiatic mainland in Malaya, Indo-China, and Thailand. It is by far the most numerous and most generally dispersed of the Thailand members of the genus. It occurs throughout the Central district in the Menam Nan, the Meping, the Mekok, and the Mekong in the Northern area; in both branches of the Meklong, in headwaters of the Menam Mun, in Peninsular Thailand in the Tapi River, the Tale Sap, the Tale Noi, and the Patani River, in the Chantabun River, Southeastern region; and in brackish waters of the Gulf of Siam off the mouths of various rivers.

This is the largest of the local mystids. Weber and de Beaufort give a length of 35 cm. in the Indo-Australian Archipelago, but in Thailand the fish reaches more than 60 cm. in length and the thickness of a man's thigh, and examples 20 to 35 cm. long are common.

The usual color of the back is plain blackish or blackish green, the underparts whitish, the fins mostly purplish or violet, the adipose fin with a light edge; there is, however, minor variation dependent on age or size and locality. Thus, a medium-sized fish from the Menam Chao Phya above Bangkok, April 24, 1926, had the caudal and anal fins black and the adipose fin with a sharply defined black edge, a light green submarginal area, and the center dark green; and several specimens 15 cm. long from the Meping at Chiengmai March 10, 1924, had the back very light green, the sides golden, the belly white, the dorsal and caudal fins pale green, the anal and ventral fins pink with a white edge, and the pectoral fins yellow.

The spawning season is not sharply defined and is protracted. A fish 32 cm. long taken in the Chantabun River at Chantabun June 11, 1926, had very large ovaries with nearly ripe eggs 1 mm. in diameter, while fish in spawning condition have been observed in the Menam Chao Phya in November.

A fish, 13 cm. long, taken in headwaters of the Menam Mun near Pakjong January 19, 1925, had its stomach crammed with large red ants.

This species bears a large number of vernacular names along the Menam Chao Phya and its tributaries. It shares with *Tachysurus* the name *pla kot*, often with a qualifying adjective, as *pla kot mor* and *pla kot chalong*. In Northern Thailand, in the Meping and the Mekok, the only designation heard is *pla kot*. On the Meklong at Kanburi and Saiyok on the western branch of the Meklong, the fish is called *pla klang* or *pla kot klang*. About the northeast section of the head of the Gulf of Siam, in the lower Bangpakong River and at Cholburi, names applied are *pla kot na*, *pla kot kao* (*kao*=white), and *pla kot lueng*. Going down the Malay Peninsula, we find *pla kayeng* and *pla kot chong luang* in use at Bandon, and *pla kot* in the Tale Sap and the Tale Noi, while in Patani province the fish bears the same designation as in Sumatra, *ikan baung*.

MYSTUS PLANICEPS (Cuvier and Valenciennes)

Bagrus planiceps Cuvier and Valenciennes, 1839, vol. 14, p. 421 (Java).
Mystus planiceps Fowler, 1935a, p. 104, fig. 30 (Bangkok); 1937, p. 148 (Bangkok, Tachin Rayong); 1939, pp. 40, 58 (Huey Yang, Trang).

The claims of this species to a place in the Thailand fauna rest on the existence in the British Museum of an adult specimen from

Ayuthia, presented by the Siamese Museum many years ago, and on the recent records by Fowler of numerous specimens, the largest 28 cm. long, from Central, Peninsular, and Southeastern Thailand. The fish is known also from Java, Borneo, Sumatra, Malacca, and Perak.

MYSTUS WYCKII (Bleeker)

Bagrus wyckii BLEEKER, 1858 (189a), p. 156 (Java).
Mystus wycki SMITH, 1929, p. 12 (Meyom).
Mystus wyckii FOWLER, 1935a, p. 104, fig. 31 (Bangkok).

The first Thai record for this species, previously known only from rivers of Sumatra and Java, was published in 1929 and was based on a specimen 40.4 cm. long, obtained from the Meyom, north of Lampang, in Northern Thailand, by Phya Daruphan Pithaks, chief conservator of forests. Several specimens had been taken for the Siamese Bureau of Fisheries in earlier years: One in the upper Menam Chao Phya, November 26, 1923; one in the Lopburi River at Lopburi, Central Thailand, October 22, 1926; two in the east branch of the Kanburi River, Central Thailand, September 10 and 12, 1928. A fish found in the Bangkok market September 11, 1929, had come from Lante, on the Menam Chao Phya, and another in that market November 19, 1929, had been caught at Koh Yai, on the same river. In the Deignan collection are one specimen 15 cm. long from the Meping at Chiengmai, and another obtained by A. R. Buchanan, from the Mechem, a tributary of the Meping, at a point about 50 miles above its mouth.

The largest example met with was 48 cm. long, which is probably near the maximum length attained.

The species may be recognized easily by its very broad, flat head with smooth upper surface and upward-directed eyes, the dark violet back and sides, the white underparts, whitish areas on the upper side of the orbit, in the interorbital space, and on the posterior margin of the opercle, with a sharply defined creamy yellow edge on the upper and lower borders of the caudal fin and on the anterior edge of the anal and ventral fins. There is considerable variation in the length of the barbels, depending doubtless on age. Normally the maxillary barbels reach to the dorsal fin or even close to the adipose, but in a specimen from the Kanburi River these barbels extend beyond the base of the anal fin, while the mandibulary barbels, which usually reach no farther than the branchial openings, in this specimen reach to the tip of the pectorals.

The vernacular name given the fish at its first-mentioned Thai locality was *pla kot kang mor* (pot-sided catfish). Among the fishermen in the Bangkok region this rare fish is known as *pla kot kao* (crystal catfish).

MYSTUS HAVMÖLLERI H. M. Smith

FIGURE 86

Mystus havmölleri SMITH, 1931a, p. 24 (Ronpibun).
Mystus stigmaturus FOWLER, 1934a, p. 94, figs. 41, 42 (Nakon Sritamarat); 1939, p. 58 (Trang).

This species seems to be limited to a comparatively small area in the Province of Nakon Sritamarat, Peninsular Thailand. It was first taken in 1927 in a small stream near Ronpibun by the late R. Havmöller, and next met with in 1933 in the waterfall stream on Kao Chong, near Trang.

The largest specimen in hand is 9 cm. long.

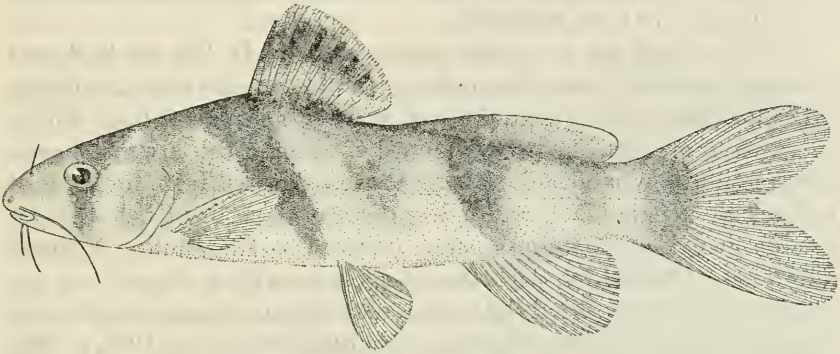

FIGURE 86.—*Mystus havmölleri* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

It is believed that *M. stigmaturus* Fowler, described from six specimens 6.8 to 8 cm. long, is this fish, the only difference mentioned by Fowler being in the color pattern. His specimens, larger than the type of *M. havmölleri*, seem to represent simply a later, and probably more typical, arrangement of the markings.

The vernacular name in the Trang district is *pla kayeng khao.*

MYSTUS CAVASIUS (Hamilton)

Pimelodus cavasius HAMILTON, 1882, pp. 203, 379 (Gangetic provinces).
Hypselobagrus macronema BLEEKER, 1865 (356), p. 175 (Siam).
Macrones nigriceps PETERS, 1868, p. 271 (Siam).—WEBER and DE BEAUFORT, 1913, vol. 2, p. 337, fig. 145 (Siam).—HORA, 1923b, p. 171 (Nontaburi); 1924a, p. 468 (Tale Sap, inner lake).
Hypselobagrus nigriceps SAUVAGE, 1881, p. 161 (Menam).
Macrones cavasius KÁROLI, 1882, p. 178 (Siam).
Mystus nigriceps FOWLER, 1934a, p. 94 (Chiengmai, Chiengsen); 1934b, p. 337 (Bangkok); 1935a, p. 102 (Bangkok); 1937, p. 146 (Bangkok, Pitsanulok, Kemarat).
Mystus rhegma FOWLER, 1935a, p. 102, fig. 27 (Bangkok).

The range of this species extends from Java, Borneo, and Sumatra to Malaya and Thailand, and thence to Burma and India. The species frequents rivers, canals, and lakes, and locally at least does not enter salt or brackish water.

In addition to the Thailand localities cited in the synonymy, the fish has been collected in various small streams in Nakon Sritamarat; in the Tapi River near Bandon; in the Meklong at Potaram, in the Menam Chao Phya as far north as Lopburi; and in the Sikuk and the Chao Chet, tributaries of the Menam Chao Phya. In addition to the record for Eastern Siam in the Mekong at Kemarat (Fowler, 1937), there is at hand a specimen collected in February 1929 in the Pong River at Pong, in the Mekong drainage.

The maximum length of specimens collected in Thailand is 20 cm. In the East Indies a length of 33.5 cm. has been reported, and Day gives a length of 45 cm. for India.

The fully adult fish is usually plain colored. In life the back and sides may be brassy green, the underparts whitish; the dorsal, adipose, and caudal fins bright green, the anal and ventrals pale salmon with a milky white margin, the pectorals dusky. Young fish always show a light longitudinal band, a dark band above separated from the color of the back by a pale band, and a less distinct dark band below, these juvenile markings sometimes being retained in the adult. A round well-defined blackish or dark brown spot, somewhat larger than the eye, on the side just behind the head is seen in some examples; this spot is indicated in the figure in Weber and de Beaufort (vol. 2, 1913, p. 336) but is not referred to in their description.

The union of *M. nigriceps* Cuvier and Valenciennes (1839) with *M. cavasius* (Hamilton) (1822) seems proper and desirable. Although *nigriceps* has not been ascribed to Burma or India, *cavasius* was reported from Thailand by Károli (1882), and the existence in the British Museum of two specimens labeled *cavasius* collected in the Mewang, Central Thailand, by Arthur S. Vernay has prompted an inquiry as to the species represented by the two names. This inquiry has led to the conclusion that no essential differences are disclosed by the descriptions and figures of *M. nigriceps* as published by Bleeker and Weber and de Beaufort and the description and figure of *M. cavasius* as published by Day. Bleeker (301, vol. 2, p. 58, 1862) stated that his species *macronema* (antedated by 7 years by *nigriceps* which he placed in the synonymy) is very close to *cavasius*. The supposed differences that he indicated (*cavasius* having its hood almost smooth, its body more slender, its scapular base smooth, its dorsal higher and more pointed, and its dorsal spine shorter), do not stand the test of analysis and comparison of specimens.

A critical examination of specimens of the same size in the U. S. National Museum, some called *M. cavasius* from the Irrawaddy at Mandalay, Burma, and some called *M. nigriceps* from the Tale Noi in Peninsular Siam, shows almost perfect agreement, with the exception that in the Burmese examples the top of the head and the scapular bone are much more rugose (whereas, according to Bleeker, the opposite condition should exist).

As bearing further on the question of the specific identity of *M. cavasius* and *M. nigriceps*, the writer received from J. R. Norman, in charge of the fish collection in the British Museum, the following letter, dated March 1, 1937:

> On receipt of your letter I got out specimens of *Macrones cavasius* and *M. nigriceps* and compared these carefully. I have no special knowledge of this group of fishes and it is possible that somebody who knew them well might be able to see minor points of difference. I am unable to detect any of importance and am of the opinion that the two forms are identical.

The fish *Mystus rhegma* Fowler, based on a single specimen 6.8 cm. long, is believed to be the present species. The space between the dorsal and adipose fins, the principal feature on which the species is separated from *M. nigriceps* (Cuvier and Valenciennes), is somewhat more than in average specimens but is thought by the present writer to represent individual variation. The three indistinct dark longitudinal bands on which stress is laid (although only two are mentioned in the description of the species) are characteristic of young *M. cavasius*. Fowler (1935a) cites three specimens of *M. nigriceps* with the "dorsal and adipose fins connected by a membrane," but his figure of one of them shows the fins close together but unconnected, and in the descriptions of the species by Weber and de Beaufort and others these fins are referred to as contiguous but unconnected.

This fish throughout its range in Thailand is known as *pla kayeng*, sometimes shortened to *pla yeng*. In allusion to the very large adipose fin of a translucent light green color, the fish in parts of the Menam Chao Phya is called *pla kayeng bai khao* (*bai khao*, rice leaf).

MYSTUS MICRACANTHUS (Bleeker)

Bagrus micracanthus Bleeker, 1846 (3), p. 151 (Batavia).
Hypselobagrus micracanthus Sauvage, 1881, p. 161 (Menam).
Mystus micracanthus Fowler, 1934a, p. 94 (Chiengmai); 1934b, p. 337 (Ban Thung Luang); 1937, p. 146 (Kemarat).—Herre and Myers, 1937, p. 69 (Singora).—Fowler, 1939, p. 43 (Krabi).

Until a comparatively recent date this species was known only from rivers of Sumatra, Borneo, and Java. It was first detected in Thailand in 1927, when, on February 7, a specimen 8 cm. long was collected in the Chantabun River, Southeastern region. In the next year, on July 14, one 12.5 cm. long was obtained in the Tadi River, Nakon Sritamarat, Peninsular Thailand. Fowler extended the range to the Meping (Northern area) and the Mekong (Eastern region).

Herre and Myers (1937), besides recording specimens from Johore, Malacca, and Perak, apparently the first citations for Malaya, had one specimen from the market in Singora, probably caught in the Tale Sap, Peninsular Thailand.

This is a small species, possibly not much exceeding a length of 15 cm.

Genus HETEROBAGRUS Bleeker

Heterobagrus Bleeker (337), Versl. Meded. Akad. Wet. Amsterdam, vol. 16, pp. 354, 355, 1864. (Type, *Heterobagrus bocourti* Bleeker.)

HETEROBAGRUS BOCOURTI Bleeker

Heterobagrus bocourti Bleeker, 1864 (337), p. 355 (Siam); 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—Bocourt, 1866, p. 19, pl. 1, figs. 1, 1a, 1b (Bangkok).—Sauvage, 1881, p. 162 (Siam).

Prajadhipokia rex Fowler, 1934b, p. 339, figs. 3, 4 (Bangkok); 1935a, p. 106 (cited as synonym of *Heterobagrus bocourti*); 1937, p. 152 (cited as distinct from *H. bocourti*).

Heterobagrus bocourtii Fowler, 1937, p. 150, figs. 48–51 (Pitsanulok).

This striking fish, peculiar to Thailand, collected by Bocourt from the Menam Chao Phya at Bangkok in 1861–2, was made the type of a new genus and new species by Bleeker in 1864 but it was not actually described until 1866, when Bocourt published a very full generic and specific account from the manuscript furnished by Bleeker.

For about 60 years after the fish was first collected and made known to science it did not figure again in zoological literature. It was rediscovered by the writer, who in 1923 found it abounding in parts of the Menam Chao Phya between Paknampo and Bangkok and in the Menam Sak below the barrage at Dha Luang. It was first recorded from the Menam Mun near Korat, Eastern Thailand, in 1926, and 10 years later was collected by de Schauensee in the Menam Nan near its mouth at Pitsanulok. During a number of years the fish was found to be very abundant at Lopburi.

The type specimen was 23.5 cm. long, which seems to be about the maximum length attained by the species.

Color note based on numerous living specimens from the Lopburi River October 22, 1926. General color of head, back, and side bronze, belly golden, a narrow dark longitudinal stripe in the bronze color of the side; a rounded blackish area larger than eye on lateral line immediately behind the head, the area divided by a vertical crescentic or lunular area of glistening white and the part of the spot anterior to the white area more intense than that posterior thereto; dorsal and ventral fins green, blood-red at base and with dusky area on interradial membranes; adipose fin green; caudal fin blackish green; pectorals green, with blood-red base.

This fish may be readily recognized by its long, compressed body; small, pointed head; pair of maxillary barbels extending to the caudal fin; very slender nondenticulated dorsal spine, its length twice the depth of the body; very long, high adipose fin arising closely behind the dorsal; deeply forked caudal fin, with the upper lobe always the longer and often filamentous.

Fowler (1934b) described *Prajadhipokia rex* as a new genus and new species based on a specimen 17 cm. long from Bangkok. The next year he pronounced *P. rex* a synonym of *Heterobagrus bocourti*. In 1937, however, having had before him a specimen of *H. bocourti* 18.9 cm. long from the Nan River at Pitsanulok, which he described and figured, he reconsidered *P. rex* as valid, owing to assumed differences in such characters as gill rakers, teeth, coloration. The present writer is unable to recognize as of generic or even specific value the minor differences between specimens of *H. bocourti* and the description and figures of *P. rex*, and believes they represent only individual variation. Thus, Fowler records the gill rakers in *P. rex* as 4+9, slender, lanceolate, 0.75 of gill filaments, and in *H. bocourti* as 4+12, lanceolate, 0.8 of gill filaments. This difference of 3 gill rakers on the long arm of the first gill arch cannot be regarded as important, and 3 specimens taken at random from a lot of *H. bocourti* from the Lopburi River have the gill rakers on one side 4+7, 4+10, and 4+11.

The fish is well known to the fishermen and is given the name *pla kayeng* with various qualifying adjectives. Thus, at Paknampo it is called *pla kayeng mu* (*mu*, pig) in allusion to the shape of the muzzle, at Lopburi and Korat it is known as *pla kayeng tong* or *dong* (*tong*, banner) in allusion to the high dorsal fin, and on the Menam Sak the long translucent adipose fin has given rise to the name *pla kayeng bai khao* (*bai khao*, rice leaf).

Family SISORIDAE

The Thailand representatives of this family fall into four genera of widely different aspect which may be recognized readily by the following characters:

1*a*. No thoracic adhesive apparatus.

  2*a*. Gill openings wide, extending on ventral surface; dorsal fin with a strong osseous spine; adipose fin short, its base about equal to that of anal; caudal fin deeply forked; pectoral and ventral fins not modified to act as an adhesive apparatus.

    3*a*. Head depressed, its upper surface naked and bony; eyes superior, mouth crescentic; bases of mandibular barbels in a strongly curved line; gill membranes united, free from isthmus. Size large, in rivers__ Bagarius

    3*b*. Head compressed, its upper surface covered with thin skin; eyes lateral; mouth straight, transverse; bases of mandibular barbels in a straight transverse line; gill membranes joined to narrow isthmus. Size medium or small, in mountain streams______________________ Gagata

2*b*. Gill openings narrow, restricted to side above pectoral fins; adipose fin very long, its base 3 to 4 times length of base of anal; caudal fin small, lunate; dorsal fin with no osseous spine; pectoral and ventral spines enlarged and transversely striated to form an adhesive apparatus, lips broad, reflected, and flattened to serve as sucking organ. Size small, in mountain streams____ **Oreoglanis**

1*b*. A thoracic adhesive disk formed of longitudinal folds of skin. Size small; in mountain streams______________________________________ **Glyptothorax**

Genus BAGARIUS Bleeker

Bagarius Bleeker (91), Verh. Batav. Genootsch., vol. 25 (Bengal), p. 121, 1853. (Type, *Pimelodus bagarius* Hamilton.)

BAGARIUS BAGARIUS (Hamilton)

Pimelodus bagarius Hamilton, 1822, pp. 186, 378, pl. 7, fig. 62 (locality not given).

Bagarius yarrelli Boulenger, 1903, p. 303 (Patani River).

Bagarius sp. Vipulya, 1923, p. 225 (Menam Chao Phya).

Bagarius bagarius Smith, 1930, p. 55 (Siam).—Fowler, 1934a, p. 93 (Chiengmai).

This species, very striking in form and color, ranges from India, Burma, Thailand, and French Indo-China to Sumatra, Borneo, and Java. It occurs throughout the length and breadth of Thailand in the larger streams, but is not found in abundance anywhere. Among the localities from which specimens have been examined are the Meping at Chiengmai, the Mekok (tributary of the Mekong) at Chiengrai, the Menam Nan, the Meklong at Kanburi and the east branch (Kwe Yai) of the Meklong north of Kanburi, and the Patani.

The species reaches a length in excess of 2 meters, but examples as long as a meter are now rare in Thailand.

It is a voracious and predatory fish. Although feeding primarily on small fishes, it consumes also frogs and shrimps. In the Menam Chao Phya it is said by Prince Vipulya to hide under logs and floating houses.

The vernacular name borne by the fish throughout Thailand is *pla kae*.

Genus GAGATA Bleeker

Gagata Bleeker (189), Act. Soc. Indo-Neerl. (Siluri), vol. 4, pp. 35, 204, 1858. (Type, *Gagata typus* Bleeker.)

GAGATA CENIA (Hamilton)

Pimelodus cenia Hamilton, 1822, p. 174, pl. 31, fig. 57 (Bengal).

Inhabiting the rivers of India and Burma, this species has not heretofore been reported from Thailand, but its presence was to be expected in the Salwin basin. Five specimens, 7.6 to 8.1 cm. long, taken by Deignan at Ta Ta Fang, on the Salwin in Western Thailand, October 13, 1936, have been compared with and found to agree with specimens in the U. S. National Museum from the Irrawaddy at Mandalay, collected by Fea and reported on by Vinciguerra (1889–90, p. 249). Adult fish, which reach a length of 30 cm., have a plain grayish body color with the distal part of the dorsal, adipose, anal, ventral, and pectoral fins black and the caudal whitish. In the young in hand there are four dark dorsal blotches, which extend on the side below the lateral line, the adipose fin has a sharply defined black edge, and each caudal lobe has at its base a black oblique stripe extending outward from the apex of the fork.

Genus OREOGLANIS H. M. Smith

Oreoglanis H. M. Smith, Journ. Siam Soc., Nat. Hist. Suppl., vol. 9, p. 70, 1933. (Type, *Oreoglanis siamensis* H. M. Smith.)

OREOGLANIS SIAMENSIS H. M. Smith

Oreoglanis siamensis Smith, 1933a, p. 70, fig. 4, pl. 3 (Mekang); 1934b, p. 293 (Melao).

The type locality for this interesting species is the Mekang, a clear, cold swift stream on Doi Angka tributary of the Meping. A Karen, living in a village on the stream, with a cast net caught the first specimens, in company with small serpentheads (*Ophicephalus gachua* Hamilton), in December 1928. The type and paratype are 7.1, 9.1, and 10.8 cm. long, taken from the same place in September 1935, and a single specimen, 5.1 cm. long, the smallest example known, collected June 8, 1935, by A. R. Buchanan in Huey Um Meng, a swift brook tributary to the Mechem, which is an affluent of the Meping.

When the Harvard Primate Expedition visited Doi Angka in April 1937, the fish was again met with, and six specimens 7.8 to 12.1 cm. long were preserved and have been examined.

The only other known specimen came from the Melao, a tributary of the Meleng, which flows into the Meping; it was taken with a cast net in December 1932, in company with 9 or 10 species of small fishes, and came from a point 725 meters above sea level, where the Melao was a swift brook.

The Melao specimen, caught shortly before dusk, was kept alive in a wicker basket and examined the next morning. It was found to be almost uniformly olive-green above, fleshy pink below, with a creamy-white ovate spot on the back on each side of the base of the dorsal fin. From an account of the fish published in 1934 (Smith, 1934b), the following extract is made. In its normal resting attitude, the fish kept its adhesive apparatus in action even in water having no current. It attached itself indifferently to any surface—stone, glass, porcelain, wood basket-work, or vegetation—and the sucking action of the lower lip was supplemented by corrugations on the front and sides of the head; these corrugations becoming less distinct in preservative.

The respiratory movements of the opercular flaps were rapid but not very marked. As the fish faced the current, the long nasal barbels were fully extended vertically and at their base the nostrils were conspicuous as triangular openings, the apex of which reached nearly half the length of the barbels. There was no obvious current of water into the mouth and out of the branchial openings; possibly a feeble current of water to the gills through the branchial openings was induced by the movements of the gill flaps.

This fish, which differs so strikingly from the other catfishes in the mountain streams of Thailand, seems to be known to the mountain people, who give the name *pla tit hin* (stone-sucking fish) to no other fish.

Genus GLYPTOTHORAX Blyth

Glyptothorax BLYTH, Journ. Asiatic Soc. Bengal, vol. 29, p. 154, 1860. (Type, *Glyptothorax trilineatus* Blyth.)

The *Glyptothorax* fishes are small inhabitants of mountain streams, in which they are aided in maintaining themselves by means of a corrugated thoracic disk, which acts as an adhesive apparatus. Criteria for specific determination are the length of body and of caudal peduncle with reference to depth, the degrees of depression of the head and the ratio of length to width, the length of the occipital process, the length of the maxillary and nasal barbels, the shape of the thoracic disk, the degree of granulation of the skin, the length of serrature of the dorsal and pectoral spines, the origin of the ventral fins with reference to the dorsal, and the coloration. The numerous local species may be identified by the following characters:

1*a*. Origin of ventral fins approximately under last rays of dorsal fin.
  2*a*. Body very slender, its depth (in Siamese specimens) contained 6 to 6.5 times in standard length; length of caudal peduncle 2 to 2.5 times its least depth--platypogonoides
  2*b*. Body less slender, its depth contained 4 to 5.5 times in standard length.
    3*a*. Body dark brown, marked by sharply defined white longitudinal stripes (one on midline of back from head to caudal fin, one along lateral line from head to caudal fin, one on median ventral surface between ventral and caudal fins); depth of body 4.6 to 5.5 times in standard length, varying with age; length of caudal peduncle 2.25 to 2.5 times its least depth-- trilineatus
    3*b*. Body not marked by white longitudinal stripes; length of caudal peduncle 1.3 to 2 times its least depth.
      4*a*. Body with large blackish or dark brown blotches; depth of body 4.6 times in its length; caudal fin much longer than head------ lampris

4*b*. Body without large blackish or dark brown blotches; caudal fin equal to, longer than, or shorter than head.

5*a*. Depth of body less than 4 times in standard length; origin of dorsal fin midway between tip of snout and midbase of adipose fin; caudal fin longer than head; color above reddish brown; a few small round black spots on side, most numerous on caudal peduncle; lateral line whitish; abdomen and underside of head pale yellow; dorsal fin black, with a narrow white edge and a median white bar extending forward and upward from posterior border of fin; caudal fin reddish brown spotted with black, its upper and lower edges with white areas, lobes tipped with white, central part white; anal fin white, with blackish base and an isolated brown spot on median part of anterior rays; ventral fins white; pectoral fins white, obscurely mottled with brown on upper surface------------------------------------ callopterus

5*b*. Depth of body 4.25 to 4.65 in standard length.

6*a*. Color above varying from gray or reddish brown to dark purple, marbled with yellow or brown, and more or less thickly covered with small black spots irregularly arranged; belly and underside of head yellowish; dorsal, adipose, and pectoral fins dark brown with white border; ventral and anal fins white, with one or two black bars, or dark color may involve most of fins; caudal fin mostly dark brown or black, tips of lobes white; depth of body 4.25 to 4.65 in length; length of caudal peduncle 1.3 to 2 times its least depth; origin of dorsal fin midway between tip of snout and adipose fin---------------------- major

6*b*. Color above dark brownish, with numerous small black spots irregularly scattered over body and head; belly and underside of head yellowish white; fins darkish, without distinct pattern; depth of body 4.3 times in standard length; length of caudal peduncle 2 times its least depth; origin of dorsal fin midway between tip of snout and posterior base of adipose fin--- prashadi

6*c*. Color above uniform dark brown; belly and under side of head whitish; lateral line white; a wing-shaped yellow spot on back at front of dorsal fin; all fins dark brown at base, white distally, pectorals with a median dark cross band; depth of body 4.25 times in standard length; length of caudal peducle 1.4 times its least depth; origin of dorsal fin midway between tip of snout and adipose fin--------------------------------------buchanani

1*b*. Origin of ventral fins posterior to a line drawn vertically from base of last dorsal ray-- fuscus

GLYPTOTHORAX PLATYPOGONOIDES (Bleeker)

Pimelodus platypogonoides BLEEKER, 1855 (136), p. 272 (Lahat, Sumatra).

Glyptothorax dorsalis VINCIGUERRA, 1889–90, p. 246, pl. 7, figs. 4, 4a (Metan, Burma).—SMITH, 1934b, p. 298 (Meyuam).

Glyptothorax siamensis HORA, 1923b, p. 168, pl. 12, figs. 1–3 (Nakon Sritamarat).

Gymnothorax dorsalis SMITH, 1933a, p. 75 (Peninsular Siam).

Glyptothorax platypogonoides FOWLER, 1934a, p. 89 (Chiengmai).

The type and, until 1929, the only known specimen of Dr. Vinciguerra's *Glyptothorax dorsalis* came from Metan, in Tenasserim, Burma, not far from the border of Western Thailand. From the time of Vinciguerra's description until 1929 the species seems to have been lost sight of. At that time a specimen that was clearly referable to this form was collected in a tributary of the Tapi River in Peninsular Siam. In October 1932, five other specimens were obtained by the Siamese Forest Department for the Siamese Bureau of Fisheries in the Meyuam, at Mesarieng in Northern Thailand, and in January 1933 the writer took another specimen in the same place.

More recently this species has been found to be common in the Meping at Chiengmai. Fowler recorded a series of 159 specimens taken between December 1932 and March 1933; and Diegnan took a dozen specimens in April 1935. The latter have the entire upper surface of the brown body and head thickly covered with pale rounded or elongate flattened tubercles, and all show, as their most conspicuous marking, a whitish saddle-shaped spot corresponding with the interspinous dorsal plate (as described and figured for *G. dorsalis* by Vinciguerra) and a similar spot involving the occipital process and the skin on either side. The largest of three males was 9.3 cm. long, the average being 9.1 cm.; of 7 females the largest was 8.1 cm. long, the smallest 7.4, and the average 7.7; 2 females of 7.4 cm. had the abdomen distended with well-developed eggs. A fish of this lot that was partly digested and had evidently been in the stomach of another fish was a female, 9.1 cm. long to base of caudal fin, fully distended with ripe eggs which were 0.8 mm. in longest diameter and 0.6 mm. in shortest diameter. The midline of the back posterior to the dorsal fin showed a continuous series of exposed bony scutes. Dr. Hora, who kindly examined the specimen and identified it as *G. platypogonoides*, wrote:

> The dorsal scutes are the ends of neural spines which, due to partial maceration of the tissue, project beyond the skin. Such artifacts led some of the earlier ichthyologists to distingush genera, and among siluroids we have an exactly similar case in the genera *Ailia* Gray and *Acanthonotus* Gray. For the latter it was stated by the author that "a series of small spines" is situated before the adipose dorsal.

Vinciguerra compared his fish with various Indian species but not with forms from the Indo-Australian Archipelago. Had he done so, he would undoubtedly have observed the resemblance between *G. dorsalis* and *G. platypogonoides.* In body proportions, fin rays, size of fins, length of barbels, and other characters, the two forms agree closely, and even in coloration there is little disagreement. With the information now available, *dorsalis* is to be regarded as a synonym of *platypogonoides.*

It seems probable that the single specimen of *Glyptothorax* collected by Dr. Malcolm Smith from a stream in the hills of Nakon Sritamarat, Peninsular Thailand, and described by Dr. Hora (1923b) under the name *G. siamensis*, may likewise prove to be the present species, formerly credited with being peculiar to Sumatra. A comparison of Hora's description and figures with Bleeker's *Pimelodus platypogonoides* indicates that the differences referred to by Hora perhaps may not exist. At any rate, more material is certainly needed before the distinctness of *G. siamensis* from *G. platypogonoides* can be satisfactorily established.

GLYPTOTHORAX TRILINEATUS Blyth

Glyptothorax trilineatus BLYTH, 1860b, p. 154 (Tenasserim).
Glyptothorax laosensis FOWLER, 1934a, p. 88, figs. 28–30 (Bua Yai, Chiengmai); 1939, p. 57 (Trang).

Described from the Sittang River in Burma in 1860, this species has since been reported from other parts of Burma, from India, and from Nepal, and in recent years it has been found in Thailand.

This is one of the largest members of the genus. In Burma it reaches a length in excess of 30 cm. The largest Thai example, from Doi Angka, is 18.3 cm. long.

Among the local members of the genus, this fish is easily recognizable by its uniformly blackish brown or chestnut-brown back and sides, lighter underparts, and a definite arrangement of white or pale yellow longitudinal stripes; one median dorsal, from occiput to upper base of caudal fin, one from the eye or the upper end of the gill opening along the lateral line to the midbase of the caudal fin, and one, the least distinct, from the postventral region to the lower base of the caudal fin.

Under the name *G. laosensis* Fowler described as a new species a fish 6.8 cm. long taken in 1933 at Bua Yai, in Eastern Thailand, with a paratype 5.6 cm. long taken in 1932 in the Meping at Chiengmai. Over 60 additional specimens 4 to 7.5 cm. long were noted by Fowler as coming from a waterfall stream near Trang, Peninsular Thailand. The Harvard Primate Expedition in April 1937 obtained 4 similar specimens 11 to 18.3 cm. long from a tributary of the Meping on Doi Angka, Northern region.

All these specimens are identifiable as *G. trilineatus* and are in agreement with a specimen 10 cm. long from the type locality in the Sittang drainage, Burma, sent to the U. S. National Museum by the Indian Museum in Calcutta through the courtesy of Dr. S. L. Hora, and with two small specimens from the Fea collection obtained on Mount Carin in the Sittang basin. The differences between Fowler's specimens and those from Burma referred to by Day (1878) and Hora (1923c, p. 29), such as the presence or absence of papillae on the skin, may be due in part to age; thus, while in Fowler's specimen the skin was thickly covered with minute papillae and Hora in old specimens found the papillae had become obliterated, in July 1940 Hora reported (in a letter) that he had examined a large number of fresh specimens from Assam and Burma in all of which the skin was finely papillated.

GLYPTOTHORAX LAMPRIS Fowler

Glyptothorax lampris Fowler, 1934a, p. 91, figs. 34–36 (Chiengmai).

This species, known from a single specimen 5.5 cm. long, is distinguished from other species wholly by its color differences.

GLYPTOTHORAX CALLOPTERUS, new species

Figure 87

Description.—Body rather strongly compressed, its greatest depth contained 3.8 times in standard length; length of caudal peduncle 1.75 times its least depth and 1.6 times in length of head; head moderately depressed, its length contained 3.4 times in standard length and 1.25 times its width; a well-marked median depression on top of head extending from nostrils to behind eyes; eye contained over 10 times in length of head, 4.5 times in snout, and 3.3 times in interorbital space; nasal barbel extending halfway to eye, maxillary barbel reaching to end of first fourth of pectoral spine, mandibular barbel reaching base of pectoral spine, mental barbel more than half length of mandibular and reaching beyond gill opening; thoracic adhesive apparatus as long as head less snout, its width 0.8 its length; occipital process about 2.5 times as long as broad at its base; body, head, and adipose fin thickly covered with minute tubercles.

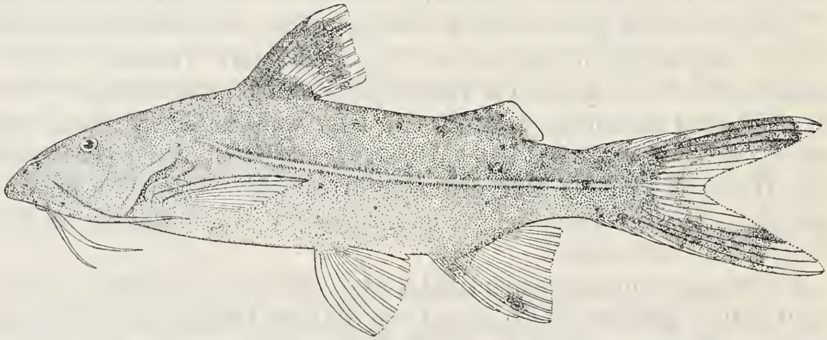

Figure 87.—*Glyptothorax callopterus*, new species: Type (U.S.N.M. No. 109820). Drawn by Miss Jane Roller.

Fins: Origin of dorsal fin midway between tip of snout and middle of base of adipose fin; dorsal rays I, 6, the rather stout spine 0.5 head, longest branched ray 1.8 times in head and 1.5 times in depth of body; length of dorsal base contained 1.5 times in space between dorsal and adipose fins; adipose fin entirely over anal fin, its base somewhat longer than base of dorsal; caudal fin longer than head, deeply forked, its median rays less than 0.5 length of fin; anal fin larger than dorsal, its rays iv, 10, its longest ray 1.5 in head and its base 1.75 in head; ventrals approximately reaching origin of anal, less than two-thirds length of pectorals, ventral rays i, 6; pectoral rays I, 7, the spine strong and coarsely denticulated, longest rays about 0.8 head and equal to depth of body.

Coloration: Upper part of body and head rich reddish brown, abdomen and underside of head pale yellow; a few small round black spots on side, most numerous on caudal peduncle; lateral line whitish; dorsal fin black, with a narrow white edge and a median white bar extending from posterior border of fin forward and upward about halfway to anterior border; caudal fin reddish brown, with small blackish spots, upper and lower edges with white areas, tips of lobes white, and a white U-shaped area involving the central part of the fin; anal fin white, with a blackish brown base and an isolated brown spot on median part of anterior rays; ventral white; pectoral whitish, anterior rays obscurely mottled with light and dark brown on upper surface.

Type and paratypes.—The type (U.S.N.M. No. 109820) 6.9 cm. long was collected September 2, 1933, in a waterfall stream on Kao Chong, near Trang, in Peninsular Thailand. Two paratypes (U.S.N.M. No. 109819) are 6.5 cm. long.

GLYPTOTHORAX MAJOR (Boulenger)

FIGURE 88

Akysis major BOULENGER, 1894a, p. 246 (Sarawak, Borneo).
Glyptosternon major SMITH, 1929, p. 13 (hill stream, Kao Sabap).

This species, previously known from rivers of Borneo, was definitely added to the Thailand fauna in 1927, when two specimens, the largest a female 6.5 cm. long with well-developed ova, were collected by Luang Masya Chitrakarn in a waterfall brook near the base of

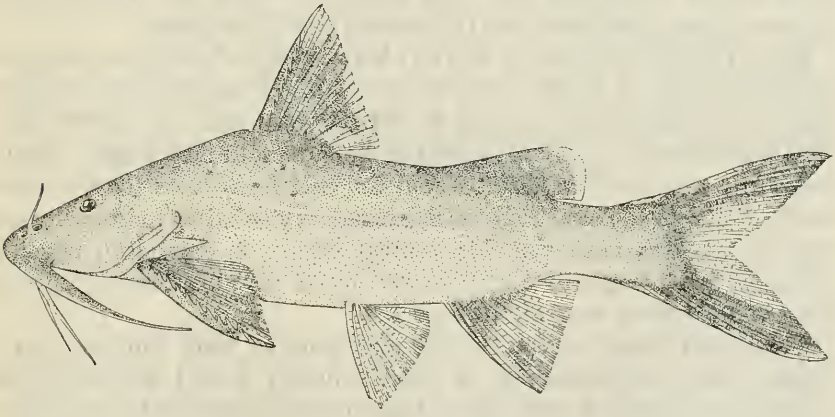

FIGURE 88.—*Glyptothorax major* (Boulenger). Drawn by Luang Masya; courtesy of the Thailand Government.

Kao Sabap, Southeastern Thailand. The smaller specimen was sent to the British Museum and there compared by J. R. Norman with Boulenger's type of *Akysis major*, 13 cm. long.

GLYPTOTHORAX PRASHADI Mukerji

Glytothorax prashadi Mukerji, 1932, p. 281, fig. 1 (Kyenchaung River, Lower Burma).

This species, otherwise known only from a single specimen about 6.5 cm. long from Burma, was collected by the writer at two places in the Tadi River, Nakon Sritamarat, Peninsular Thailand, in July 1928. Five specimens, 6.8 to 8.9 cm. long, were preserved. Comparison with the type showed full agreement.

The relationship of this species to other local forms is indicated in the key. The coloration is plain.

GLYPTOTHORAX BUCHANANI, new species

Figure 89

Description.—Body moderately compressed, its depth under dorsal fin contained 4.25 times in standard length; length of caudal peduncle 1.4 times its depth and 1.5 times in length of head; head moderately depressed, its length 0.25 standard length and slightly greater than its width; eye 7.3 in head, 4 in snout, and 2.7 in interorbital space; nasal barbel extending 0.5 distance to eye, maxillary barbel reaching to beginning of second third of pectoral spine, mandibular barbel reaching base of pectoral spine, mental barbel somewhat more than 0.5 mandibular; thoracic adhesive apparatus of roughly quadrangular shape, with an acute point anteriorly, its width about 0.8 its length; occipital process twice as long as broad; entire surface of body and head thickly beset with low, soft tubercles, which are lacking only on the sucking apparatus and the median line of abdomen.

Fins: Origin of dorsal fin midway between tip of snout and adipose fin; dorsal rays I, 6, the spine 1.5 in head and the longest soft ray equal to depth of body; adipose fin entirely over anal fin, thickly covered with minute tubercles, separated from dorsal fin by a space about twice the length of its base; caudal fin well forked, its longest rays shorter than head; anal rays iv, 8, longest ray equal to longest dorsal ray and shorter than ventral; ventral rays i, 6, extending beyond origin of anal, origin of fin under last dorsal ray; pectoral as long as head and reaching ventral, the rays I, 9.

Coloration: Back and sides, top and sides of head uniform dark brown; belly and underside of head whitish; lateral line white; a conspicuous yellowish wing-shaped spot on either side of the first dorsal ray; all fins dark brown at base, white distally, the pectorals with a median dark cross band.

Type and paratypes.—The type (U.S.N.M. No. 117754) 6.9 cm. long was taken by A. R. Buchanan, of Chiengmai, June 20, 1935, in the Metum, a small swift affluent of the Mechem, tributary of the Meping, in Northern Thailand. H. G. Deignan collected at the same place two others, 4.7 and 4.2 cm. long, paratypes (U. S. N. M. No. 119824).

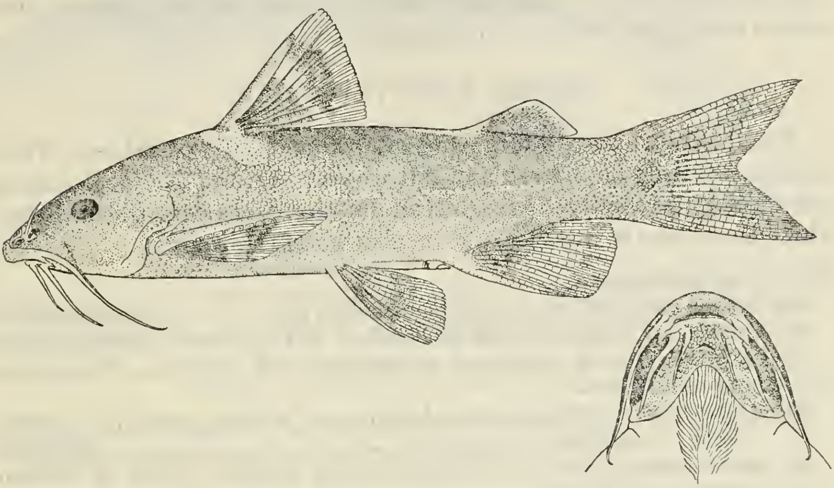

Figure 89.—*Glyptothorax buchanani*, new species: Type (U.S.N.M. No. 117754). Drawn by Mrs. Aime M. Awl.

Remarks.—From the described species of *Glyptothorax* from Thailand, India, and the Indo-Australian Archipelago, this form seems to differ in the combination of a comparatively short body, moderately elongate caudal peduncle, origin of the ventral fins under the last ray of the dorsal fin, and striking and peculiar coloration: a sharply defined narrow white stripe following the lateral line and a yellow butterflylike spot on the back at the front of the dorsal fin.

It is a pleasure to name this species for A. R. Buchanan, of the Borneo Company, Ltd., who in June, July, October, and November, 1935, made for H. G. Deignan small but valuable collections of fishes from the Mechem and various tributaries thereof, from which no fishes had previously been obtained for scientific purposes.

GLYPTOTHORAX FUSCUS Fowler

Glyptothorax fuscus Fowler, 1934a, p. 89, figs. 31–33 (Chantabun, Nakon Sritamarat).

Fowler regarded this species, known from nine specimens from Southeastern Thailand and Peninsular Siam, 5.5 to 7.9 cm. long, as related to *G. platypogon*, of Java, Sumatra, and Borneo, differing in proportions, longer nasal barbel, more backward extension of the base of the anal fin, and coloration. The species agrees further with *platypogon* in having the insertion of the ventrals posterior to the dorsal base, and is the only local form having this feature. In 1939, however, Fowler said: "Likely *Glyptothorax fuscus* Fowler 1935 [sic] may be synonymous with *G. prashadi*." This suggestion can hardly be accepted if the position of the ventral fins with reference to the dorsal, the length of the maxillary barbels, coloration, and similar characters have significance in this genus.

Family TACHYSURIDAE

The tachysurids are a large and important family of fishes in Thailand, inhabiting both fresh and salt waters. Of the five local genera, which may be easily distinguished by the characters given below, three are known to practice oral incubation of their eggs.

1*a*. Palatal teeth present.
  2*a*. Barbels restricted to a minute mandibulary pair-------- **Batrachocephalus**
  2*b*. Barbels restricted to a stiff semiosseous maxillary pair-- **Osteogeneiosus**
  2*c*. Barbels in 3 pairs (maxillary, mandibulary, and mental)---- **Tachysurus**
1*b*. Palatal teeth absent.
  3*a*. Mouth opening wide, extending behind eyes; a single series of incisorlike teeth in each jaw-- **Ketengus**
  3*b*. Mouth opening small, not extending nearly to eyes; a band of villiform teeth in each jaw------------------------------------ **Hemipimelodus**

Genus BATRACHOCEPHALUS Bleeker

Batrachocephalus Bleeker (3), Nat. Geneesk. Arch. Ned.-Ind., ser. 2, vol. 3, pp. 147, 176, 1846. (Type, *Batrachocephalus ageneiosus* Bleeker.)

BATRACHOCEPHALUS MINO (Hamilton)

Figure 90

Ageneiosus mino Hamilton, 1822, p. 159 (Ganges).
Batrachocephalus mino Smith, 1931d, p. 179 (Chantabun and Nam Cheo Rivers).—Fowler, 1935a, p. 102 (Bangkok); 1939, p. 43 (Krabi).

One of the most curious of the catfishes, its range embraces Thailand, India and Burma, where it appears to be not common, and Java, Borneo, and Sumatra, where, according to Bleeker, many specimens were collected and distributed among various European museums. It is one of the rarest catfishes in Thailand, being unknown there until 1926. Only five specimens have as yet been recorded locally, three from the Southeast area, collected for the Siamese Bureau of Fisheries in 1926 and 1927, one from Bangkok, and one from Krabi reported by Fowler in 1935 and 1939.

A length of 25 cm. is attained.

The resemblance of the head of this fish to that of a frog is striking. The eye is large and placed near the tip of the short blunt snout. The dorsal and pectoral spines are denticulated on both anterior and pos-

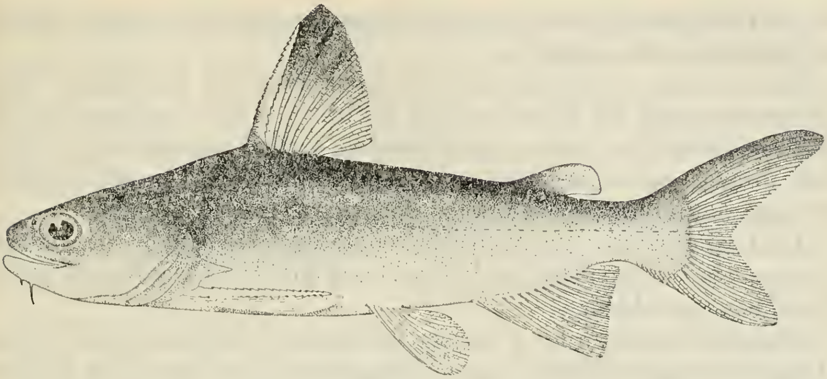

FIGURE 90.—*Batrachocephalus mino* (Hamilton). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

terior edges. The development of barbels is less than in any other local catfish, being restricted to a minute pair on the chin.

Genus OSTEOGENEIOSUS Bleeker

Osteogeneiosus BLEEKER (3), Nat. Geneesk. Arch. Ned.-Ind., ser. 2, vol. 3, pp. 146, 173, 1846. (Type, *Osteogeneiosus macrocephalus* Bleeker.)

OSTEOGENEIOSUS MILITARIS (Linnaeus)

Silurus militaris LINNAEUS, Syst. Nat., ed. 10, p. 305, 1758 (Asia).

Ranging from Java, Borneo, and Sumatra to India, this species is one of the commonest catfishes around the shores of the Gulf of Siam, in the lower courses of rivers, and in the inner lake of the Tale Sap. It may at once be identified by the single pair of stiff, semiosseous barbels that arise on the snout and extend to or beyond the base of the pectorals.

A length of 30 cm. is reached in Thailand.

Oral incubation is practiced in this species. The egg-laying and egg-hatching season appears to be prolonged and may extend over the entire year. Thus, males 18 to 23 cm. long collected on July 2, 1923, in the Bangpakong River 8 miles from the Gulf of Siam, in fresh water with a strong current, had mouthfuls of eggs in various shapes of development; females collected in Bandon Bight, Gulf of Siam, on September 21, 1923, had well-developed eggs, some 1 cm. in diameter; a male taken in the Tale Sap on October 6, 1923, had in the mouth 12 undeveloped eggs of a rich yellow color; a female, 30 cm. long, taken in the Gulf of Siam at Pakpoon, Nakon Sritamarat, October 20, 1923, contained large ovarian eggs; and females 25 and 25.5 cm. long, collected from a trap in the Gulf of Siam off the mouth of Menam Chao

Phya December 22, 1923, had large transparent orange-red eggs nearly or quite ready for extrusion.

The various species of *Osteogeneiosus* described by Bleeker and properly placed by Weber and de Beaufort in the synonymy of *O. militaris* were for the most part based on such characters as the relative proportions of length of body, depth of body, and length of head, in apparent ignorance of the variations due to sex.

In Thailand this fish has little repute as food, and is one of the cheapest in the markets. In India a poor quality of isinglass is made from its swim bladder.

This fish is known by a variety of names in different parts of its Thailand range. Often it is not distinguished from species of *Tachysurus* and is given the same names, *pla kot* and *pla uk* (in allusion to the sound made by the fish), with or without qualifying words, such as *pla kot hua on* (*hua on*, soft head), *pla kot nud*, *pla kot kokaso*, *pla kot som oui* (*som oui*, buxom or plump), and others. In Peninsular Siam, as in the Tale Sap, the name *pla kot hua on* may be shortened to *pla hua on*. In the Bangpakong River a name in use is *pla uk hua san*.

Genus TACHYSURUS Lacepède

Tachysurus Lacepède, Histoire naturelle des poissons, vol. 5, p. 150, 1803. (Type, *Tachysurus sinensis* Lacepède.)

Some of the fishes of this genus are found regularly in fresh water in Thailand, but the genus is primarily marine. It seems desirable, however, to include in this account all the species known from Thailand rather than to attempt an artificial separation.

The number of species is large, and some of them are very abundant and economically important.

Oral incubation has been observed in nearly all the local species, and it seems probable that this habit is common to the genus.

Secondary sexual characters are marked, involving the shape and size of the head, the position and shape of some of the fins, and the development of special appendages on the ventral fins.

There has been no opportunity to observe the spawning habits, and it is not known how fertilization of the eggs is effected and how the eggs are taken into the mouth of the male. During the protracted period of hatching, which may cover 6 to 8 weeks, the male takes no food, and his fasting is further prolonged by the retention of the young in his mouth until the complete or partial absorption of the yolk sac. By the time the young have left the shelter of the parental mouth, the male undergoes considerable emaciation, and it may be assumed that in fishes as ravenous and gluttonous as the catfishes the spawning season is a time of great stress for the males.

The ovaries undergo bilateral development and the eggs attain a large size before extrusion. The number of eggs produced by a single fish is relatively small, probably never exceeding 100 at one time in any local species. As they may be from 1 to 1.5 cm. in diameter when ripe, very little space is left in the abdominal cavity for liver, stomach, intestines, and other organs, all of which undergo shrinkage or temporary atrophy, and in the later stage of the ovarian development digestion is necessarily suspended, with the intestines reduced to mere strings and the passage of food physically impossible.

The most important characters for separating the species are the teeth. Such characters, especially those of the palatine teeth, have been used largely in the preparation of the key, which has been adapted from Weber and de Beaufort's excellent presentation.

- 1*a*. Palatine teeth in one group on each side.
  - 2*a*. Patches of palatine teeth ovoid or elliptical.
    - 3*a*. Palatine teeth coarsely granular or molarlike in large suboval parallel patches.
      - 4*a*. Band of teeth in upper jaw 6 to 8 times as long as broad and not medianly constricted.
        - 5*a*. Palatine teeth placed far back, separated from jaw teeth by a space nearly equal to length of patch; dorsal spine stout---- maculatus
        - 5*b*. Palatine teeth placed well forward, separated from jaw teeth by a space equal to width of patch; dorsal spine moderately stout ---------- gagora
      - 4*b*. Band of teeth in upper jaw 3 times as long as broad and medianly constricted; dorsal spine very slender---------- sciurus
    - 3*b*. Palatine teeth villiform or sharply conical.
      - 6*a*. Palatine teeth in small oval patches, smaller than eye, their long axis oblique, separated from each other by a space 2 or 3 times their least diameter---------- truncatus
      - 6*b*. Palatine teeth in transverse ovoid or elliptical patches about 2 times as long as broad, separated from each other by a space about equal to their least diameter---------- macronotacanthus
  - 2*b*. Patches of palatine teeth roughly triangular.
    - 7*a*. Band of teeth in upper jaw long, narrow, arcuate, 8 to 10 times as long as broad; anterior side of palatine patch longest, rounded, and separated from its fellow and from jaw teeth by a space somewhat less than breadth of band; head shields granular; dorsal spine very long and strong, granulated on anterior surface, equal to or longer than head---------- caelatus
    - 7*b*. Band of teeth in upper jaw 4 to 5 times as long as broad; patches of palatine teeth large, compact, separated from each other and from jaw teeth by a space about one-third breadth of jaw band; head shields mostly smooth; dorsal spine weaker, less granulated, shorter than head---------- venosus
- 1*b*. Palatine teeth in 2 groups on each side.
  - 8*a*. Patches of palatine teeth in antero-posterior series; teeth granular.
    - 9*a*. Anterior patch of palatine teeth consisting of a few granular elements, sometimes altogether wanting, far separated from jaw teeth and from posterior patch, which is large, oval, with its long axis inclined outward; sides of occipital process straight- argyropleuron

9*b*. Anterior patch of palatine teeth small, oval, placed about midway between jaw teeth and posterior patch, which is parallel with its fellow, elongate pyriform, its anterior end rounded, its posterior end terminating in a long point turned slightly outward; occipital process oval------------------------------------ leiotetocephalus

8*b*. Patches of palatine teeth in transverse series; teeth villiform.

10*a*. Jaw teeth in a long, rather narrow band, which may have a median constriction; palatine teeth in 2 egg-shaped patches on each side, the inner patch about half the size of outer; occipital process large, granular, almost circular, touching the broad butterfly-shaped basal bone of dorsal spine---------------------------------- sagor

10*b*. Jaw teeth in a long, rather broad, slightly curved band; inner palatine teeth in a small oval patch which is joined to long outer patch curved downward and outward; occipital process long, triangular, its truncate posterior side reaching the crescentic basal bone of dorsal spine--- stormii

1*c*. Palatine teeth in 3 groups on each side, each group having a roughly triangular shape, with its base directed anteriorly and formed by 2 small transversely united quadrangular patches behind and connected with which is an elongated subtriangular patch, with its rounded apex directed backward (genus *Netuma* Bleeker)------------------------------ thalassinus

TACHYSURUS MACULATUS (Thunberg)

Silurus maculatus THUNBERG, 1792, p. 31 (Japan).

Arius maculatus WEBER and DE BEAUFORT, 1913, vol. 2, p. 284 (Siam).—HORA. 1924a, p. 467 (Tale Sap).

Tachysurus maculatus FOWLER, 1935a, p. 100 (Bangkok, Sriracha).

This species, of wide range (Indo-Australian Archipelago, Philippines, China, and probably India), is abundant in Thailand and it is known from all parts of the Gulf of Siam as well as from the outer and inner lakes of the Tale Sap, and the Tapi, Chao Phya, Bangpakong, and Chantabun Rivers. Four specimens taken July 2, 1923, November 10, 1923, and August 16, 1924, from the Bangpakong and Chao Phya Rivers, two being males with oral eggs, differ from typical *T. maculatus* in having a shorter head, shorter band of teeth in upper jaw, smaller eye, more acute humeral process, and longer dorsal and pectoral spines.

The species reaches a length of 40 cm., but in Thailand the largest examples observed have been 30 cm. Full maturity is attained in both males and females 16 cm. long.

An unusually large number of vernacular names is borne by this fish in different parts of its range in Thailand, some of them shared with related species, some peculiar to it. In the Chantabun River, where the fish abounds and large quantities of its eggs are marketed at the town of Chantabun, the names in use are *pla kot*, *pla kot kokaso*, *pla kot tale* (*tale*=sea), and *pla kot na nu* (*na nu*=mouse face). In the Bangpakong River, a very muddy stream where ovigerous fish gather in immense numbers, local names are *pla kot khao* (*khao*=white), and *pla uk hua san* (*hua san*=short head). On the Menam Chao Phya a name in use is *pla kot nu* (*nu*=mouse). A Tapi River designation is *pla kot pak kuat* (*pak kuat*=lizard mouth), while in the Tale Sap one may hear the names *pla kot* and *pla hua on.*

TACHYSURUS GAGORA (Hamilton)

Pimelodus gagora Hamilton, 1822, pp. 167, 376, pl. 10, fig. 54 (Bengal).
Arius macracanthus Günther, 1864, vol. 5, p. 167, 2 figs. (Siam).—Sauvage, 1881, p. 162 (Siam).
Arius gagora Day, 1878, vol. 2, p. 465, pl. 107, fig. 2 (Siam).

This common fish of India is known from Thailand by a specimen, 7.5 inches long, in the British Museum, obtained in the Jamrach purchase. It was described by Günther, as *Arius macracanthus*, but it was regarded by Day (doubtless properly) as the same as Hamilton's *Pimelodus gagora.*

In India the fish reaches a length of 3 feet.

TACHYSURUS SCIURUS (H. M. Smith)

Arius sciurus Smith, 1931a, p. 30 (Tapi River).

In the type locality, the Tapi River near Bandon, Peninsular Thailand, this fish is common and it is said to reach a length of more than a meter. The largest specimens observed by the writer were 60 cm. long; the type was 25 cm. The only other locality where the fish has been met with is the lower Menam Chao Phya at Paknam, where a specimen 18 cm. long was taken on November 10, 1923.

In the Bandon market eggs of this fish were seen exposed for sale during a number of days in September 1923. They had been removed from the mouths of the males in agglutinated clusters, looking like bunches of grapes, the largest clusters being 18 cm. long and the eggs 1.4 to 1.5 in longest diameter.

This species belongs in the groups of tachysurids that Bleeker (Atlas Ichthyologique) called *Pseudarius*, characterized by having the granular or molarlike palatal teeth in two large separated patches. Its nearest relative is *T. microcephalus*, reported only from rivers of Borneo. In that species, however, the smaller head is much broader than deep (as contrasted with a head whose depth equals its breadth), the maxillary barbels extend beyond the head (instead of reaching only one eye-diameter beyond the eye), and the dorsal and pectoral spines are much stouter.

The local vernacular name is *pla kot.*

TACHYSURUS TRUNCATUS (Cuvier and Valenciennes)

Arius truncatus Cuvier and Valenciennes, 1840, vol. 15, p. 64 (Java).—Bleeker, 1865 (356), p. 175 (Siam).—von Martens, 1876, p. 400 (Bangkok).—Sauvage, 1881, p. 162 (Siam).—Weber and de Beaufort, 1913, vol. 2, p. 308 (Siam).
Cephalocassis truncatus Bleeker, 1859–60 (239), p. 102 (Siam).
Tachysurus truncatus Fowler, 1934a, p. 93 (Bangkok).
? *Hemipimelodus cochlearis* Fowler, 1935a, p. 101, fig. 25 (Bangkok, Paknam).

An abundant, strongly marked species of Java, Sumatra, and western side of the Malay Peninsula, this fish in Thailand is found mostly in the lower courses of the larger rivers, and at times may occur in large numbers. From all the other members of the genus in Thailand, it may be readily distinguished by its much-depressed head, truncate snout, and greenish yellow color, often rich creamy yellow below.

The maximum length given for this species by Bleeker is 33 cm. The average for a dozen adult specimens chosen at random in the collection of the Siamese Bureau of Fisheries was 31 cm., the largest being a female of 42 cm. with nearly ripe eggs, taken in the Tale Sap on July 9, 1929.

Fowler's *Hemipimelodus cochlearis* bears a strong resemblance to this species. It is described and figured as having a small patch of teeth on each palatine, thus excluding it from the genus *Hemipimelodus.*

The vernacular names differ somewhat with the locality. In the Menam Chao Phya the fish is known as *pla uk lueng.* In the Bangpakong, the next large stream to the eastward, the same name, together with *pla kot lao* (*lao*, spear), is in use, while in the Meklong, the large stream entering the northwest corner of the Gulf of Siam, the fishermen call this fish *pla kot hua lao* (*hua lao*, spear head). Still another name is in general use in the inner lake of the Tale Sap, where this fish is abundant and known as *pla kan lao* (*kan lao*, spear handle).

TACHYSURUS MACRONOTACANTHUS (Bleeker)

Arius macronotacanthus Bleeker, 1846 (3), p. 150 (Batavia).—Hora, 1924a, p. 468 (Singora).

This species is known from the Straits Settlements, Sumatra, and Java. Its place in the Thailand fauna rests on a single young specimen reported by Hora from Singora.

TACHYSURUS CAELATUS (Cuvier and Valenciennes)

Figure 91

Arius caelatus Cuvier and Valenciennes, 1840, vol. 15, p. 66 (Batavia).—Weber and de Beaufort, 1913, vol. 2, p. 310 (Siam).—Károli, 1882, p. 178 (Siam).
Cephalocassis coelatus Bleeker, 1859–60 (239), p. 102 (Siam).
Arius coelatus Bleeker, 1865 (356), p. 175 (Siam).
Tachysurus caelatus Fowler, 1935a, p. 100 (Bangkok, Paknam).

One of the common fishes of the genus, this species is found along all the shores of the Gulf of Siam, in the Tale Sap, and in the tidal reaches of all the rivers. It is also common in the Dutch East Indies, and ranges thence to the west coast of India.

The average length of 20 adult Thailand specimens was 20.5 cm; the longest, 28.3 and 29.5 cm., were females.

A specimen, 27 cm. long, taken in the Gulf of Siam off Sriracha June 8, 1927, had its left maxillary barbel bifid at the tip.

Very long and thick dorsal and pectoral spines, coarsely granulated on their anterior surface and serrated behind, characterize this species. The adipose fin is either entirely black or bears a large black spot.

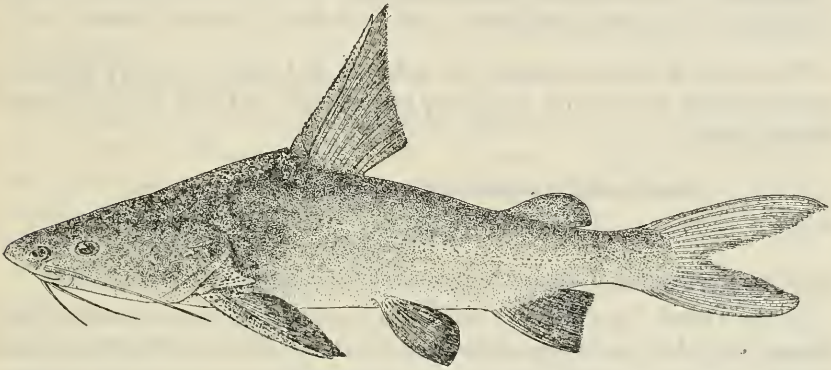

FIGURE 91.—*Tachysurus caelatus* (Cuvier and Valenciennes). Drawn by Luang Masya; courtesy of the Thailand Government.

The species shares with the related ones the names *pla kot* and *pla uk*, with such qualifications as *pla kot deng* (*deng*, red, in allusion to a general reddish color in life), *pla kot lueng* (*lueng*, yellow, in allusion to a brassy yellow color of some freshly caught individuals), and *pla uk pak kwang* (*pak kwang*, wide mouth).

TACHYSURUS VENOSUS (Cuvier and Valenciennes)

FIGURE 92*b*

Arius venosus CUVIER and VALENCIENNES, 1840, vol. 15, p. 69 (Rangoon).
Tachysurus venosus FOWLER, 1934a, p. 93 (Bangkok).

While *Tachysurus venosus* is of wide distribution (Philippines, Dutch East Indies, Singapore, Malacca, Andamans, Ceylon, and Madagascar), and common in parts of its range, it appears to be rather rare in Thailand. In the large collections made for the Siamese Bureau of Fisheries, the writer obtained the fish at only one locality, at the mouth of the Chantabun Estuary, at Lem Sing, Southeast Thailand, on June 9, 1926, while fishing with a hand line from a row boat; three specimens 21 and 22 cm. long, all mature females were caught.

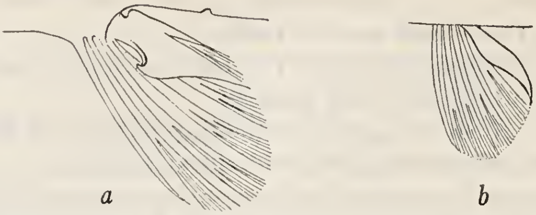

Figure 92.—Modified ventral fins of female Thailand catfishes (*Tachysurus*). The "claspers" are developed on the pelvic fins to assist in holding the large eggs. The eggs are extruded one at a time, so that the male fish may take them in his mouth. *a*, Left pelvic fin of *Tachysurus argyropleuron; b*, left pelvic fin of *Tachysurus venosus*.

The local fishermen called the fish *pla kot lueng* (*lueng*, yellow), reported that it attained a slightly larger size, and said its food value is very good.

TACHYSURUS ARGYROPLEURON (Cuvier and Valenciennes)

Figure 92*a*

Arius argyropleuron Cuvier and Valenciennes, 1840, vol. 15, p. 104 (Java).

In the Dutch East Indies this fish is known from sea, estuaries, and rivers, but the specimens collected by the writer in Thailand were from Langsuen and Singora, on the western side of the Gulf of Siam, and from Cham Ham Bight, on the eastern side of the gulf. These were taken in August, September, and October, and ranged from 13.5 to 33 cm. in length, as against a maximum of 46 cm. recorded by Bleeker.

TACHYSURUS LEIOTETOCEPHALUS (Bleeker)

Arius leiotetocephalus Bleeker, 1846 (4), p. 292 (Batavia).
Tachysurus leiotetocephalus Smith, 1934b, p. 299 (Gulf of Siam).

The published records for this fish include Celebes, Java, Singapore, and Malacca, in sea and estuaries, as well as the Gulf of Siam. It is the most abundant of the sea catfishes of Thailand and is a schooling fish, usually going in very large numbers along both rocky and muddy shores, and often being caught in immense quantities in bamboo traps. As many as 5,000 fishes were taken in one day in February 1924 in a single trap off Bangplasoi, at the northeast corner of the Gulf of Siam. The appearance of the fish in a given section is irregular and the abundance varies greatly from month to month or year to year.

The species may be readily recognized by the large ovate occipital process that completely occupies the space between the head and the basal bone of the dorsal spine. This process is easily detached and may often be seen in numbers on sandy or gravelly beaches, where carcasses of the fish have disintegrated.

Almost everywhere on the Thailand coasts the fish has a name, *pla tukang*, which is given to no other species. This designation may be derived from *pedukang* and *belukung*, Malay names for the fish.

TACHYSURUS SAGOR (Hamilton)

Pimelodus sagor Hamilton, 1822, p. 169 (Ganges).

Many specimens of this broad-headed fish, with large subcircular occipital process and with conspicuously granulated top of head and humeral processes, have been taken on both sides of the Gulf of Siam, in the sea, in the estuaries, and in the short tidal rivers. Besides the Dutch East Indies, the species is known from the Straits Settlements and India.

It reaches a length of 45 cm.

The striking palatine teeth masses, usually in 4 transverse patches, are subject to some variation. An aberrant arrangement in a specimen, 35 cm. long, taken from Bandon Bight September 29, 1923, was an undivided lenticular patch separated from its fellow by a space wider than the diameter of the eye.

The fish in life usually shows silvery white or bluish green cross bands on back and sides.

Oral incubation reaches a climax in this species. A male fish, 35 cm. long to the tip of the caudal lobes, taken on October 20, 1923, at Pakpoon, on the west side of the Gulf of Siam, had in his mouth 48 eggs measuring 1.1 to 1.2 cm. in diameter. Another fish caught at the same time had in his mouth an agglutinated mass of eggs, 39 in number, resembling a bunch of grapes. In the posterior part of the pharynx, behind the eggs, were 4 hatched fish 4 cm. long. Obviously this male had taken in a fresh batch of eggs before all the young of the previous batch had been able to leave the mouth.

TACHYSURUS STORMII (Bleeker)

Cephalocassis stormii Bleeker, 1858 (189a), p. 246 (Sumatra).

This is apparently a rare species in Thailand waters. Only a single specimen is referable to it, this an ovigerous female, 40 cm. long, taken in the Menam Chao Phya above Bangkok, on April 30, 1928. The species is recorded from Sumatra and Borneo.

TACHYSURUS THALASSINUS (Rüppell)

Bagrus thalassinus Rüppell, 1835–1840, p. 75, pl. 20, fig. 2 (Massaua, Abyssinia).

As its name implies, this is a marine species, apparently rarely entering streams but often approaching their mouths. To the many localities from which this form has been reported (Australia, New Caledonia, Red Sea, Zanzibar, Philippines, and East Indian islands) it is possible to add the Gulf of Siam and Puket, a Thailand island in the Bay of Bengal.

The length of a meter is attained, but apparently not in Thailand waters.

In life the rich reddish brown color of the back and sides shows numerous narrow, parallel, transverse iridescent cross bands corresponding with lines of pores, as in Bleeker's striking plate of *T. sagor* (*Hexanematichthys sundaicus*) in Atlas Ichthyologique.

In the vicinity of Lem Sing, Southeast Thailand, the fish sometimes goes in large schools both in the gulf and in the Chantabun Estuary; specimens taken January 6, 1924, and February 3 and 5, 1925, were up to 30 cm. long; the local names are *pla kot tale* (*tale*, sea) and *pla kot kokaso*. A specimen 32 cm. long was taken September 24, 1923, in the Gulf of Siam off Chumporn, Peninsular Thailand, where the fish is called *pla kot*, while at Puket the name is *pla lutu* (*lutu*, blunt).

Doubtful References

Tachysurus harmandi (Sauvage), 1883b, p. 154 (Menam). Few or no diagnostic features are given. The teeth indicate *Tachysurus stormii* or perhaps *T. sagor*.

Hemiarius harmandi Sauvage, 1880, p. 230; also 1881, p. 162 (Ile de Phu-Quoc, in Gulf of Siam), p. 171, pl. 8, fig. 3.

Tachysurus melanochir (Bleeker) Fowler, 1935a, p. 100, fig. 22 (Bangkok). This species is otherwise known only from Sumatra and Borneo. The teeth as figured by Fowler suggest *T. melanochir*, but (1) all the barbels in his specimens are shorter than in the descriptions and figures of Bleeker and Weber and de Beaufort; (2) the base of the adipose fin in Fowler's figure is not longer than the bases of the dorsal and anal but less than half the length of the anal base; and (3) the absence of a black center in the yellow fins does not indicate *T. melanochir*.

Genus KETENGUS Bleeker

Ketengus Bleeker (8), Nat. Geneesk. Arch. Ned.-Ind., ser. 4, vol. 2, p. 167, 1847. (Type, *Ketengus typus* Bleeker.)

KETENGUS TYPUS Bleeker

Ketengus typus Bleeker, 1847 (7), 9 (Java); 1865 (356), p. 175 (Siam).—Sauvage, 1883b, p. 154 (Menam Chao Phya).—Weber and de Beaufort, 1913, vol. 2, p. 317 (Siam).—Hora, 1923b, p. 170 (Nontaburi).—Fowler, 1934a, p. 93 (Bangkok); 1935a, p. 100 (Bangkok).

This fish frequents the lower courses of rivers in either fresh or brackish water, and also ventures into the coastal waters within the influence of rivers. Outside of Thailand, where it is not abundant, it is found in the Andaman Islands, parts of Malaya, Sumatra, Borneo, and Java. In addition to the Menam Chao Phya, it has been collected in the Bangpakong River, in the inner lake of the Tale Sap, and in the Gulf of Siam from a stationary trap about 15 miles from the mouth of the Menam Chao Phya, September 8, 1923, at a time when a great volume of fresh water was entering the head of the gulf. A specimen in the British Museum was collected by Flower in the Menam Chao Phya.

This species may be recognized easily by its very wide mouth, short, broad head, edentulous palate, and three pairs of short barbels.

A length of 25 cm. is reached, but the usual size of specimens collected in Thailand is 12 to 15 cm.

Vernacular names for the fish are *pla uk hua hin*, reported for the Bangkok area, *pla kot hua to*, heard on the Bankpakong River, and *pla kot lueng*.

Genus HEMIPIMELODUS Bleeker

Hemipimelodus Bleeker (189), Act. Soc. Sci. Indo-Nederl. (Siluri), vol. 4, p. 236, 1858. (Type, *Pimelodus borneensis* Bleeker.)

The hemipimelodids in Thailand are in general fishes of the lower courses of the larger rivers. Of the five species ascribed to Thailand, three are of somewhat doubtful status; one, *Hemipimelodus cochlearis* Fowler (1935a), is not a member of this genus, being excluded by the presence of palatine teeth; and only one (*H. borneensis*) is a common and widely distributed fish, which occurs also in Borneo and Sumatra.

It may now be announced, possibly for the first time, that *H. borneensis*, and inferentially in other species of this genus, oral incubation is practiced as in *Tachysurus* and *Osteogeneiosus*. The eggs are large and few in number, and as extruded they are taken into the mouth of the male, where they are held during hatching and the absorption of the yolk sac. Ovigerous females develop a large pad on the inner side of the last ventral rays, the pair of pads serving to hold each egg as extruded until it can be fertilized and taken into the male's mouth.

The following characters will differentiate the species of *Hemipimelodus* inhabiting Thailand:

1*a*. Eyes subcutaneous; length of head 4 to 4.5 in standard length; gill rakers on lower arm of first arch 10; anal rays 18 to 20________________ borneensis
1*b*. Eyes with a free cutaneous rim; length of head 3.25 in standard length; gill rakers on lower arm of first arch about 12; anal rays 15_________ velutinus
1*c*. Differential characters not known; anal rays 16________________ siamensis

HEMIPIMELODUS BORNEENSIS (Bleeker)

Figure 93

Pimelodus borneensis Bleeker, 1851 (49), p. 430 (Sambas, Borneo).
Hemipimelodus borneensis Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 175 (Siam).—von Martens, 1876, p. 400 (Bangkok).—Weber and de Beaufort, 1913, vol. 2, p. 327 (Siam).—Hora, 1923b, p. 170 (Nontaburi).—Fowler, 1935a, p. 101, fig. 24 (Bangkok).

This species has been found along the entire length of the Menam Chao Phya and in some of its connecting streams. It has been collected also in both the upper and the lower reaches of the Menam Bangpakong. A specimen, 18.5 cm. long, taken in June 1923 in the Menam Chao Phya at Pakret, a short distance north of Bangkok, was compared, in December 1927, with Bleeker's type of *H. borneensis*, 17.6 cm. long, in the British Museum and found to agree perfectly.

The maximum length in local waters somewhat exceeds 25 cm. Fully mature specimens of both sexes are found from 15 cm. upward.

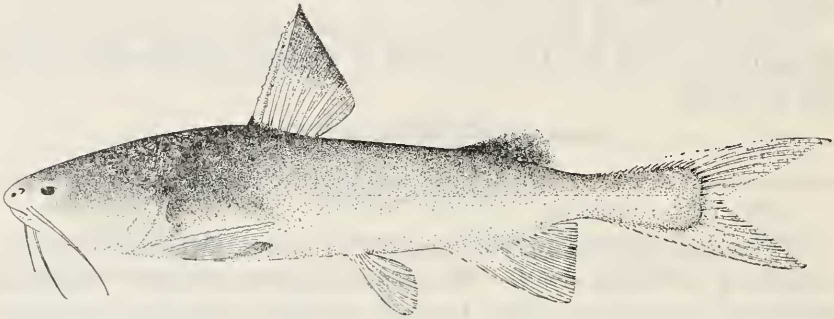

Figure 93.—*Hemipimelodus borneensis* (Bleeker). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

The ovaries develop bilaterally, and in conjunction therewith a peculiar pad forms on the inner side of each ventral fin, as in *Tachysurus*. There is no modification of the ventral fins in the male. The fully mature ovaries occupy so large a part of the abdominal cavity that the passage of food along the intestines is interfered with or altogether stopped by the time the large, clear, amber-colored eggs are ready for extrusion. Some ripe fish taken in a haul seine March 29, 1928, were 15.6 to 22.1 cm. long, had dull reddish gray back and sides, and showed a glistening white spot, smaller than the pupil, in the median cranial fontanel.

The fish is caught in considerable quantities with seines, bag nets, and other apparatus, and appears regularly in the markets of the larger river towns.

The common vernacular name is *pla uk*, in allusion to the grunting noise the fish makes when caught. Qualifying terms are added in certain localities or for certain color or other peculiarities, such as *pla uk deng* (*deng*, red), *pla uk khao* (*khao*, white), and *pla uk khem* (*khem*, needle). A name heard only on the Bangpakong River is *pla kot poh*, *kot* being equivalent to *uk* and *poh* being the kind of trap in which caught.

HEMIPIMELODUS VELUTINUS Weber

Hemipimelodus velutinus Weber, 1908, p. 225 (New Guinea).
Hemipimelodus bicolor Fowler, 1935a, p. 100, fig. 23 (Bangkok).

Hemipimelodus velutinus has heretofore been known only from northern New Guinea. It is therefore with considerable hesitation that a specimen, 25.2 cm. long, collected in the Bangkok market in May 1934 and described by Fowler as new under the name *Hemipimelodus bicolor* is referred to this species.

According to Fowler, *H. bicolor* may be known by its contrasted coloration (not shown in the figure) and may be distinguished from *H. velutinus* by having shorter barbels and an axillary pore. Not much importance may usually be attached to the colors of market specimens of fishes. In this case, the figure of *H. velutinus* in Weber and de Beaufort (1913, vol. 2, fig. 141) shows a much more striking contrast in color than Fowler's figure. As regards length of barbels, this is often a somewhat variable feature in catfishes, but Weber's description indicates that the maxillary barbels extend "to base of pectorals or somewhat farther," while Fowler's figure indicates a maxillary barbel reaching nearly the base of the pectoral. The presence of an axillary pore in *H. bicolor* and its assumed absence in *H. velutinus* are important points. Neither Weber in his original description nor Weber and de Beaufort in their secondary description make any reference to an axillary pore, although in the key to the species of *Hemipimelodus* occurring in the Indo-Australian Archipelago, *H. velutinus* is placed in a section characterized by the absence of an axillary pore. This, however, was an oversight. In a letter dated March 6, 1937, Dr. de Beaufort stated that he had just examined some typical specimens of *velutinus* and found a small slitlike pore in all of them.

For the present at least, the single Thailand specimen described by Fowler as *H. bicolor* may be referred to *H. velutinus*.

HEMIPIMELODUS SIAMENSIS Sauvage

Hemipimelodus siamensis SAUVAGE, 1878b, p. 234 (Laos siamois); 1881, p. 162, 172, pl. 8, fig. 5 (Laos siamois; Ile de Phu-Quoc, Gulf of Siam).—HORA, 1923b, p. 170 (Nontaburi).

The status of this species is uncertain. Sauvage's description is deficient in diagnostic characters. His type, 20 cm. long, came from a region where, in recent years, no hemipimelodid has been found or may be expected to occur. His poor figure of the top of the head is not suggestive. No statement is made as to depth of body, orbital margin, teeth, gill rakers, axillary pore, relative position to adipose and anal fins, and other features by which the fish might be distinguished from other species. The description of the shape of the occipital process with its strong keel applies well to *borneensis* and other species. If the species is really valid, the most promising of the features mentioned by Sauvage are the short maxillary barbels (extending to opercles), the adipose fin almost as long as the dorsal and separated therefrom by 2.5 times its own length, the pectoral spine longer than the dorsal spine and 16 rays in the anal fin, the only other species having so few rays being *H. velutinus*.

A specimen, 15 cm. long, from the Menam Chao Phya above Bangkok was identified by Hora as belonging to this species, but he did not give differential features.

Family AKYSIDAE

This family is represented in Thailand by a single genus, *Akysis*. Regan, Jordan, and others have placed the genus in the family Amblycipitidae (Amblycepidae) with *Amblyceps;* Fowler (1934a) put *Akysis* in the Bagridae. The present writer follows Weber and de Beaufort (1913, vol. 2) and Hora (1936a) in assigning *Akysis* to a separate family to include *Acrochordonichthys* (Java and Sumatra) and *Breitensteinia* (Borneo and Sumatra). The differential characters given in the key to the families of Nematognathi, together with others that might be indicated, seem to warrant the maintenance of this as a distinct family.

Genus AKYSIS Bleeker

Akysis Bleeker (189), Act. Soc. Sci. Indo-Neerl. (Siluri), vol. 4, p. 234, 1858. (Type, *Akysis variegatus* (Bleeker) = *Pimelodus variegatus* Bleeker.)

The members of this genus are diminutive inhabitants of mountain streams in Java, Borneo, Sumatra, Burma, and Thailand. Four species have been ascribed to Thailand and another (*A. pictus* Günther), described from Tenasserim, may be looked for in the adjoining parts of Thailand. The known species from Thailand may be characterized as follows:

1*a*. Nasal barbel as long as, or longer than, head; maxillary barbels 1.2 to 1.25 times length of head; all fins and barbels speckled with brown or black ---------- maculipinnis
1*b*. Nasal barbel shorter than head.
  2*a*. 7 to 10 antrorse denticles on posterior edge of pectoral spine; length of caudal peduncle twice or less than twice its depth.
    3*a*. 7 to 9 very strong teeth on pectoral spine as long as or longer than breadth of spine; nasal barbel reaching branchial opening; maxillary barbel extending to second third of pectoral spine; dark red, with longitudinal rows of yellow spots on head and transverse rows of yellow spots on body ---------- armatus
    3*b*. 10 moderately developed teeth on pectoral spine; nasal barbels not reaching branchial opening; maxillary barbel not reaching base of pectoral spine; body mostly whitish, with 3 irregular black cross bands, snout white ---------- leucorhynchus
  2*b*. 4 or 5 denticles on posterior edge of pectoral spine; length of caudal peduncle 3 times its depth or more ---------- macronemus

AKYSIS MACULIPINNIS Fowler

Akysis maculipinnis Fowler, 1934a, p. 97, fig. 46 (Southeastern Siam).

Known only from seven specimens 3.1 to 3.7 cm. long, from Chantabun, Southeastern Thailand, presumably from a tributary of the Chantabun River.

AKYSIS ARMATUS Vaillant

Akysis armatus Vaillant, 1902, p. 64 (Mahakam, Borneo).—Smith, 1931d, p. 180 (Patani).

A specimen, 4 cm. long, from the Talebun district of Patani, Peninsular Thailand, is identified as this species, otherwise known only from Borneo.

AKYSIS LEUCORHYNCHUS Fowler

Akysis leucorhynchus Fowler, 1934a, p. 97, figs. 44, 45 (Chiengmai).

Ten specimens, 2.2 to 3.3 cm. long, were reported by Fowler from the Meping at Chiengmai, Northern Thailand. In April 1935 Deignan collected eight specimens at the same place, the largest 3 cm., the smallest 2 cm. long. All these have the space between the sharply defined white snout and the first black cross band a rich dark brown. A specimen 3 cm. long is a female with large ovaries containing nearly ripe eggs.

AKYSIS MACRONEMUS Bleeker

Akysis macronema Bleeker, 1860 (271), p. 11 (Lahat, Sumatra).—Smith, 1931d, p. 180 (Chantabun River).

The validity of this species, described from Sumatra in 1860 and apparently not again detected for 70 years, and the identification therewith of eight specimens taken in the Chantabun River in Southeastern Thailand in February 1927, are discussed in the writer's paper cited above (Smith, 1931d).

The colloquial name for this tiny fish (largest 3.4 cm.) at Chantabun is *pla kayuy*.

Order CYPRINODONTES: Toothed minnows

This order, which reaches a very large development in the Western Hemisphere, is comparatively sparsely represented in the Old World. In Thailand there are only two known indigenous species and one introduced species, which fall into two families, as follows:

1*a*. Oviparous; anal fin in male not modified into an intromittent organ. Cyprinodontidae

1*b*. Viviparous; anal fin in male modified into an intromittent organ__Poeciliidae

Family CYPRINODONTIDAE: Killifishes

The local species of this world-wide family belong in two well-marked genera to which various names have been applied. The nomenclatorial questions involved have been indicated in a paper by the writer (Smith, 1938b), and the conclusions therein reached are embodied in the present treatment.

The two genera of this family that are to be found in Thailand may be differentiated by the following characters:

1*a*. Upper jaw protractile; mouth of moderate size with its corners abruptly bent downward; vomer toothed; pseudobranchiae present; branchial membranes free from each other and from isthmus; pectoral fins with their upper base at or below longitudinal axis of body________________ **Aplocheilus**

1*b*. Upper jaw not protractile; mouth small with its corners obtusely bent downward; vomer toothless; no pseudobranchiae; branchial membranes united across isthmus; pectoral fins with upper base well above longitudinal axis of body____ **Oryzias**

Genus APLOCHEILUS McClelland

Aplocheilus McClelland, Asiatic Researches, vol. 19, p. 301 (as *-chelus*, p. 261), 1839. (Type, *Aplocheilus chrysostigmus* McClelland.)

This genus was established by McClelland in 1839 with three species listed thereunder, *chrysostigmus* (new), *melastigmus* (new), and *panchax*, first described as *Esox panchax* by Hamilton in 1822. McClelland made reference to a fourth species of *Aplocheilus* and published a figure of it based on a drawing in the Hamilton collection. No name was given to the species which, on the figure, was indicated as new. This figure was the basis for Bleeker's *Aplocheilus mcClellandi*. The genus was composite and no type was indicated. In 1846 Cuvier and Valenciennes, ignoring McClelland's *Aplocheilus*, created the genus *Panchax* and placed therein four species, including Hamilton's *Esox panchax*, which they renamed *Panchax buchanani*, together with *Panchax pictum*, which is a *Betta* of the family Anabantidae. The designation of a type species in *Aplocheilus* seems to have been first made in 1863 when Bleeker ((301), 1863, vol. 3, p. 140), in a synopsis of his family Cyprinodontoides, definitely named *Aplocheilus chrysostigmus* McClelland as the type. This action was unfortunate because other published opinions of Bleeker indicate that what he did in this case was opposite to what he intended to do, for *chrysostigmus* is a synonym of *panchax*, which Bleeker, in the same synopsis, placed in the genus *Panchax*.

As a contribution to the question of the proper generic name for the fishes that have been placed in *Aplocheilus* by Weber and de Beaufort and other recent authorities, reference may be made to an interesting point raised by Dr. L. F. de Beaufort in a letter dated September 20, 1938, from which the following is quoted:

> It is true that Bleeker, Atlas Ichthyologique, III, 1863, p. 140, made *A. chrysostigma* the type of the genus, but he did it in the belief that this species shows the characteristics of the genus, as understood by Bleeker. This is clear from the following. In 1853 (Verh. Bat. Gen., XXV, p. 144) Bleeker considered

the 3 species of *Aplocheilus* of McClelland, *chrysostigmus*, *panchax*, and *melastigmus*, as synonyms of *Panchax buchanani*, without having seen these species. In 1854, however, he described *Aplocheilus javanicus* (Nat. Tijdschr. Ned. Indie, VII, p. 323) after fishes he had found at Perdana, Java, and for the first time gave a diagnosis of the genus, "Aplocheilus McCl. Bkr.," and made the following remarks, which I translate from the Dutch:

"Mr. J. McClelland was the first to designate this genus in Indian Cyprinidae (Transact. Asiat. Societ. Beng. XIX, p. 301 and 426). The characters are well indicated, but Mr. McClelland made the mistake to include *Panchax buchanani* C. V. (*Esox panchax* H. B.) among the species of *Aplocheilus*. This is the reason why Mr. Cantor in his Catalogue of Malayan Fishes (p. 252) considers the diagnosis of Mr. McClelland very incorrect and why he rejects the genus. On the authority of Mr. Cantor I formerly did the same, but after the discovery of my specimens at Perdana, which agree in habitus almost entirely with the species *Aplocheilus mcClellandi* Blkr., figured (but neither named nor described) by Mr. McClelland on fig. 4, plate 55 of his work cited above and made after a drawing in the collection of Hamilton Buchanan and which, indeed, has the characters mentioned by Mr. McClelland, it appears to me that *Aplocheilus* must be kept as a genus and that also a closer examination of the species, which Mr. McClelland has described and figured as *Aplocheilus chrysostigmus* and *Aplocheilus melastigmus*, is very desirable, to be able to judge with certainty if these species have to be accepted or rejected as synonyms of *Panchax buchanani*."

It is therefore clear that Bleeker considered at that time *Aplocheilus mcClellandi* as the type of the genus and was still very much in doubt about the species *chrysostigmus* and *melastigmus*. Now *Aplocheilus mcClellandi* Blkr. is a synonym of *A. melastigmus* (Day, Fishes of India, p. 522) and therefore this last named species has to be considered as the type of the genus.

This would be a most desirable way to dispose of this question. Unfortunately, the action of Day in making *Aplocheilus mcClellandi* a synonym of *Aplocheilus melastigmus* was unwarranted, as was the action of Bleeker in assigning McClelland's unnamed figure to the genus *Aplocheilus*. That figure, based on a drawing in Hamilton's collection, was of a fish which Hamilton called *Cyprinus* (*Cabdio*) *dancena*. This species does not belong in the Cyprinodontidae but is one of the Cyprinidae of the subfamily Abramidinae. This is listed as a synonym of *Perilampus laubuca* by Day (1878). See further, Hora (1929b).

It has been impossible to find a basis for the statement by Regan (1911, p. 324) that Bleeker "definitely restricted" *Aplocheilus* to the *melastigmus* group, a course which would have permitted the continuance of recent usage as regards the names *Panchax* and *Aplocheilus*.

From the foregoing it thus appears that the name *Aplocheilus* must be associated with fishes that have in recent years borne the name *Panchax*, and that *Panchax* is a synonym of *Aplocheilus*.

The genus *Aplocheilus* is represented in Thailand by a single species of wide Oriental distribution.

APLOCHEILUS PANCHAX (Hamilton)

FIGURE 94

Esox panchax HAMILTON, 1822, pp. 211, 380, pl. 3, fig. 69 (Bengal).
Panchax buchanani BLEEKER, 1863 (301), vol. 3, p. 141, pl. 144, fig. 3 (Bangkok); 1865 (347), p. 35 (Siam).
Haplochilus panchax VON MARTENS, 1876, p. 401 (Bangkok).
Haplochisus panchar KÁROLI, 1882, p. 181 (Siam).
Panchax panchax WEBER and DE BEAUFORT, 1922, vol. 4, p. 374 (Siam).—HORA, 1824a, p. 482 (Tale Sap).—FOWLER, 1934b, p. 348 (Krat); 1937, p. 214 (Bangkok).

The wide range of this species, from India to the Indo-Australian Archipelago includes Burma, the Malay Peninsula, and Thailand.

In Thailand it is a coastwise species, never found far from the sea but sometimes in mountain brooks. In the Menam Phya it occurs at least as far upstream as Nontaburi and probably goes farther. In the lower courses of the Tachin and other rivers of Central Thailand it is common, being usually found in drains, ditches, or pools connected with the rivers. The records for the Southeastern area are for a mountain stream on Kao Sabap (July 12, 1928), for a brackish pool at Lem Sing (March 16, 1930) and for brackish waters at Krat. In the lowlands of Koh Chang, Koh Samui, and Koh Pa-ngan, large islands in the Gulf of Siam, the fish is common. In addition to Hora's record for the Inland Sea, the present writer has taken the fish in other parts of the Peninsula—in small streams in the town of Nakon Sritamarat and in isolated grassy pools at Singora.

The maximum size of this fish is 5.5 cm.

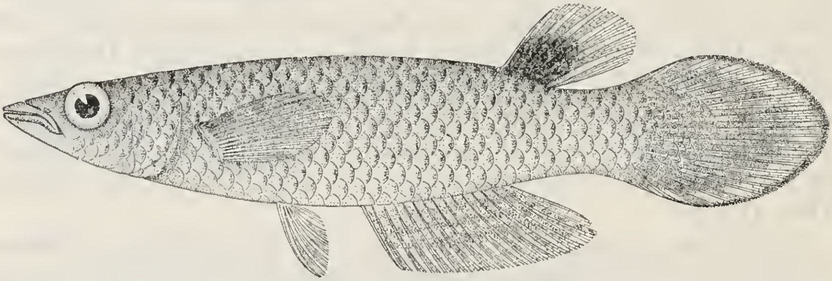

FIGURE 94—*Aplocheilus panchax* (Hamilton). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

This is a very attractive little fish whose coloration has not been fully set forth in published accounts.

Color note on living specimens from Tachin River, at Tachalom, Central Thailand, July 26, 1928: General color of upper parts light grayish brown, each scale with a dark brown edge, below white; under side of head yellow in males, white in females, in both a narrow black transverse band posterior to lower lip; snout viewed from above translucent; dorsal fin yellow, with a jet black basal spot extending from anterior margin of fin to posterior rays but not involving the last one or two rays or the bases of the first several rays, the black inclining to blue in some individuals; yellow at anterior base of the dorsal fin extending on back and in males making a conspicuous spot; caudal fin dusky yellow-red, with a narrow blackish edge in males; anal fin white at base, with a bright red zone extending its entire length and one-third of its depth in males, with a pale red border in females; ventrals rich lemon yellow in males, plain white in females; pectorals hyaline.

Specimens from a tide pool at Lem Sing, Southeastern Thailand, March 16, 1930, males: Dorsal orange with black spot, caudal rosy orange with a narrow blackish edge, anal bright orange, ventrals yellow, and pectorals hyaline. Females: Dorsal pale orange with black spot, caudal pale yellow with no dark edge, anal and ventrals white, pectorals hyaline.

The fish swims at the surface, and its presence in shallow weedy pools or in turbid drains may be disclosed only by the glistening silvery white spot on the top of the head at the occiput. It renders a distinct service to mankind by its destruction of mosquito larvae, which appear to be its chief and favorite food.

It is a great jumper. When put into a shallow vessel it may leap several feet into the air in efforts to escape. This habit is doubtless useful in enabling the fish to evade predatory animals.

This is one of the various small fishes employed by the Thai in fighting contests. Only the males fight.

Note on a contest observed at Tachalom, Central Thailand, July 28, 1923: A number of males that had been captured 2 days before were brought out, and two that showed signs of a pugnacious disposition were placed in a large circular jar. The fish closed at once and took a characteristic attitude; head to tail, with sides closely applied and with caudal fins everted at a rather sharp angle. The fish swimming at or near the surface forced each other around the jar, and apparently sought an opportunity to seize the caudal, anal, or other lower fin and bite out a piece, the jaws being armed with bands of sharp teeth and the upper jaw being protractile. The pair struggled for 10 minutes and then stopped from fatigue, without having inflicted any damage to either. The action was much less spirited than in *Betta*. The glistening white spot on the top of the head became dark in one fish, and this is said to be usual in fighting contests. These fish are matched only by boys who catch the wild fish and hold them in the rectangular jars employed for the regular fighting fish; they will fight after being in captivity 2 days, and their fighting qualities are said to increase with prolonged captivity.

Notwithstanding its small size this fish is rendered conspicuous by its peculiar shape as well as by the shining spot on the top of the head, so it is well known to the coastal people who have given it names borne by no other species: *Pla hua takua* (lead-head fish) and *pla hua ngern* (silver-head fish) in allusion to the lustrous spot, and *pla hua ngon* (scoop-head fish).

In recent years this fish has usually been called *Panchax panchax*. The genus *Panchax* established by Cuvier and Valenciennes in 1846, with Hamilton's *Esox panchax* becoming the type species by tautonymy, was a synonym of *Aplocheilus*, which has the same type species.

Genus ORYZIAS Jordan and Snyder

Oryzias Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 31, No. 1486, p. 289, 1906. (Type, *Poecilia latipes* Temminck and Schlegel.)

The name *Oryzias* is equivalent to *Aplocheilus* of Weber and de Beaufort. The applicability of this name in its present connotation was discussed by the writer (Smith, 1938b). There are various species of India, Burma, Malaya, and the Indo-Australian Archipelago in addition to the type species (*Poecilia latipes*) from the ricefields of Japan. The single species known from Thailand appears to be undescribed.

ORYZIAS MINUTILLUS, new species

Figure 95

Description.—Body compressed, head and anterior part of back depressed and flattened; depth of body 3.5 in standard length; caudal peduncle longer than deep; head 4.1 in standard length; eye large, scarcely reaching above dorsal profile of head, about 2.4 in head; snout 2.25 in eye and greater than interorbital space; mouth extending 0.5 distance from tip of snout to eye; scales in lengthwise series 27 or 28, in transverse series, 10, in predorsal region 19; a broad anal papilla.

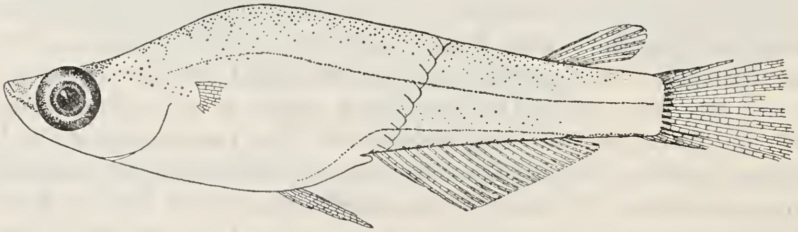

Figure 95.—*Oryzias minutillus*, new species: Type (U.S.N.M. No. 107958). Drawn by Mrs. Aime M. Awl.

Fins: Dorsal rays 6, longest ray 1.8 in head, origin of fin slightly before posterior base of anal; caudal fin as long as head, its margin rounded; anal rays 19, longest ray equal to longest dorsal ray, origin of fin midway between pupil and base of caudal; ventrals 0.5 length of head, their origin midway between tip of snout and posterior end of anal base; pectorals slightly longer than ventrals.

Coloration: Body translucent, the blackish peritoneum showing through the abdominal walls; back minutely speckled with black, the spots concentrated medianly and forming a rather well-marked stripe from occiput to caudal fin; a straight black line on side from over ventrals to base of caudal; a black line running along base of anal fin, above it a similar line which diverges anteriorly and joins the basal line at posterior end of anal fin, the two continued as a single line on under side of caudal peduncle; top of head, opercles, preorbital, and lips with black specks forming line on lips; a few widely scattered black specks on lower side of body; dorsal, caudal, and anal rays faintly outlined with black.

Type and paratypes.—The type (U.S.N.M. No. 107958) is an ovigerous female 16.3 mm. long, taken in a small canal in Bangkok, Central Thailand, May 10, 1934. Of four other specimens obtained at the same place and time three 17 mm. long were females with well-developed eggs and one 15.5 mm. long was apparently a male. Paratypes are U.S.N.M. No. 109789.

Remarks.—Of the described species from southern Asia and the Indo-Australian Archipelago, the present form most closely resembles *Aplocheilus javanicus* Bleeker, recorded from fresh and brackish waters of Java, Singapore, Malaya, and other localities. The differences, while not wide, seem to justify the recognition of the Thai fish as distinct. Thus, *javanicus* has 7 dorsal and 21 to 24 anal rays, as against 6 and 19, respectively, in *minutillus;* the squamation is quite similar, 29 or 30 scales in the lateral line in the former and 27 or 28 in the latter, with the scales in transverse series 10 in both, but while in *javanicus* the predorsal scales number 22 or 23, in *minutillus* they are 19.

In color pattern this fish conforms with species of the Indo-Australian Archipelago in having a dark stripe along the median line of the back, a very thin dark stripe along the middle of the side, and a similar stripe above the base of the anal fin converging toward its fellow on the opposite side and meeting it just behind the base of the anal fin, the combined line continued along the under side of the caudal peduncle. An additional dark line along each side of the anal fin at the very base of the rays is not referred to in descriptions of any other species of this general region.

This appears to be the smallest of the described species of *Oryzias*, attaining full maturity when only 17 mm. long. It seems altogether probable that it is not uncommon in the Bangkok region and has heretofore been overlooked because of its small size and inconspicuous coloration.

Family POECILIIDAE: Top Minnows

This family is naturally restricted to temperate and tropical waters of the Western Hemisphere. Its inclusion in the present catalog is based on the introduction of the following species into Thailand:

Genus GAMBUSIA Poey

Gambusia Poey, Memorias sobre la historia natural de la isla de Cuba, vol. 1, p. 382, 1854. (Type, *Gambusia punctata* Poey.)

GAMBUSIA HOLBROOKII (Girard)

Heterandria holbrookii Girard, 1859, p. 61 (Charleston, S. C.).
Gambusia holbrooki Smith, 1929, p. 14 (Siam, introduced).

This well-known and well-tested destroyer of mosquito larvae. native to the coastal waters of the United States from New Jersey southward, was introduced into Thailand in 1929 from Palestine, where the fish had been taken in 1922 from Augusta, Ga. From a single small lot brought into Thailand by Mrs. Emily J. Collins, many thousands have resulted, and numerous waters in the Bangkok region, in Eastern Thailand and in other parts of the country have been stocked.

The females reach a maximum length of about 5 cm., and the males 2 to 2.5 cm. Frequent broods are produced throughout the year, and in protected waters a very large number may result from a single pair in a short time. The young, about 0.8 cm. long at birth, swim actively as soon as they are born.

Order SYNENTOGNATHI: Gars and Halfbeaks

Family BELONIDAE: Gars

The gars inhabit temperate and tropical waters in all parts of the world, and are much more prominent in the sea than in rivers and lakes. Some of the marine species have a tendency to ascend rivers, and some entire genera are restricted to fresh water.

These fishes may be recognized easily by their long and slender bodies, by the prolongation of their jaws into a beak armed with rows of sharp opposing teeth, and by the insertion of the dorsal and anal fins opposite each other in the posterior fourth of the length. Besides a number of species, some of large size, in the coastal waters of Thailand, there are two genera represented in rivers and lakes often far from the sea:

1*a*. Second, third, and fourth pairs of upper pharyngeal bones tooth-bearing; lower pharyngeal bone with a median tonguelike patch______ **Strongylura**
1*b*. Only third pair of upper pharyngeal bones tooth-bearing; lower pharyngeal bone with a median elliptical patch__________________________ **Xenentodon**

Genus STRONGYLURA van Hasselt

Strongylura Hasselt, Alg. Konst. Letterbode, vol. 2, p. 130, 1823. (Type, *Strongylura caudimaculata* van Hasselt=*Belone strongylura* van Hasselt.)

STRONGYLURA STRONGYLURA (van Hasselt)

Belone strongylura VAN HASSELT, 1823, p. 130 (Java).
Mastacembelus caudimacula BLEEKER, 1865 (356), p. 176 (Siam).
Tylosurus strongylurus WEBER and DE BEAUFORT, 1922, vol. 4, p. 121 (Siam).
Strongylura strongylura FOWLER, 1934a, p. 144 (Bangkok, Chiengmai); 1935a, p. 130 (Bangkok, Paknam, Khao Nam Poo); 1939, p. 75 (Trang).

This is the only member of the genus regularly entering the fresh waters of Thailand. The species, of wide distribution in the Pacific and Indian Oceans, and primarily marine and estuarine, has been collected in the inner lake of the Tale Sap and in the Tale Noi in the Peninsula, in the lower reaches of the Menam Chao Phya, in the Meyom at Mepoon, in the Menam Sak at Khao Nam Poo, and in the Meping at Chiengmai.

The fish attains a length of 45 cm. Two fishes 27.5 and 34.5 cm. long, taken August 23, 1929, in the fresh flood water off the mouth of the Menam Chao Phya, were females with asymmetrical ovarian development: the right ovary in each fish contained nearly ripe eggs, the left ovary was less than half the size but with well-formed eggs, which would doubtless have been expelled at a second spawning time.

The vernacular name, shared with other members of the family, is *pla katung heo*. A variation heard in the inner lake of the Tale Sap at Pak Bhayoon is *pla 'tung kwai*.

Genus XENENTODON Regan

Xenentodon REGAN, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 332, 1911. (Type, *Belone cancila* Hamilton.)

The gars of this genus are of strictly fresh-water habitat in India, Burma, Ceylon, Thailand, Malaya, Borneo, Sumatra, and probably French Indo-China (Cambodia). Two closely related forms are recorded from Thailand waters.

1*a*. Scales in lateral line about 250; depth of body 1.5 times its width and contained 8 to 12 times in distance from tip of upper jaw to midbase of caudal fin; distance of dorsal origin from midbase of caudal contained 5.8 times in total length ---------- cancila

1*b*. Scales in lateral line 200 to 220; depth of body equal to its width and contained 14 to 18 times in distance from tip of upper jaw to midbase of caudal fin; distance of dorsal origin from midbase of caudal contained 4.8 times in total length ---------- canciloides

XENENTODON CANCILA (Hamilton)

Esox cancila HAMILTON, 1822, pp. 213, 380, pl. 27, fig. 70 (Gangetic provinces).
Mastacembelus cancila BLEEKER, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).
Belone cancila PETERS, 1868, p. 272 (Siam).
Xenentodon cancila HORA, 1923b, p. 175 (Bangkok); 1924a, p. 471 (Tale Sap).

From India, Ceylon, and Burma the range of this species extends through Thailand to Malaya. Records for Thailand are the Menam

Chao Phya at Bangkok; Klong Sok, a tributary of the Tapi River, and the inner lake of the Tale Sap, in the Peninsula. Specimens from Bangkok are in the British Museum as a gift from the Siamese Museum. The species ranges far inland. Two specimens 30 and 32 cm. long were obtained by H. G. Deignan near the headwaters of the Nan River at Muang Ngop, Northern Thailand, April 23, 1936, and one, 10 cm. long, from the Meping at Chengmai, Northern Thailand, April 22, 1935.

Day (1878) refers to a "variety" in the Central Provinces and at Hurdwah in which a hump on the anterior part of the back is sometimes continued as a ridge as far as the dorsal fin. A specimen, 30 cm. long (which appears to be about the maximum length attained by this species), from the basin of the Tapi River, possesses the ridge observed in some Indian examples.

The vernacular name of *pla katung heo* borne by fishes of this type is, in the Bangkok region, expanded for this species into *pla katung heo meuang*.

XENENTODON CANCILOIDES (Bleeker)

Belone canciloides BLEEKER, 1853 (85), p. 454 (Pontianak; Pangaboeang, Lampong Province, Sumatra).

Xenentodon canciloides FOWLER, 1935a, p. 130 (Bangkok); 1937, p. 214 (Bangkok, Kemarat).

This species had been known only from the fresh waters of Borneo and Sumatra until reported by Fowler from Bangkok and Kemarat (on the Mekong, opposite Cambodia).

The maximum length seems to be less than 30 cm.

The fish is extremely like *X. cancila.*

Family HEMIRAMPHIDAE: Halfbeaks[6]

Of this world-wide family of marine, estuarine, and fresh-water fishes, there are three genera represented in the fresh waters of Thailand.

The three genera are characterized as follows:

1*a*. Dorsal fin with its rays in about equal number to those in anal fin, and its origin over or in advance of that of anal.
  2*a*. Dorsal and anal rays in male not modified; species oviparous; maximum size about 30 cm -- Hyporhamphus
  2*b*. Some anal rays in male enlarged and greatly modified; dorsal fin in some species with some rays elongated; species viviparous; maximum size about 20 cm -- Zenarchopterus

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[6] The results of Dr. Albert W. Herre's recent studies of this family (A review of the halfbeaks or Hemiramphidae of the Philippines and adjacent waters, Stanford Univ. Publ., biol. sci., vol. 9, No. 2, pp. 41–86, 1944) could not be incorporated herein, as they appeared while the present publication was in press.—L. P. S.

1*b*. Dorsal fin with fewer rays than in anal fin, and its origin behind that of anal; anal fin in male with the first ray elongated and modified, and several following rays elongated; species viviparous; maximum size about 7 cm. Dermogenys

Genus HYPORHAMPHUS Gill

Hyporhamphus Gill, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 131, 1860. (Type, *Hyporhamphus tricuspidatus* Gill.)

HYPORHAMPHUS UNIFASCIATUS (Ranzani)

Hemiramphus unifasciatus Ranzani, 1842, p. 326 (Brazil).
Hemirhamphus unifasciatus Hora, 1924a, p. 472 (Tale Sap, inner lake).

This widely distributed and common fish of the Indian, Pacific, and Atlantic Oceans is represented in collections from Thailand by specimens from the inner lake of the Tale Sap, as well as from the Gulf of Siam. The first fresh-water specimens, four young, taken by Dr. N. Annandale January 12–16, 1916, were reported on by Hora (1924). Further specimens were obtained in the same locality by the writer on September 27, 1924, and July 4, 1929, the largest example, 14.8 cm. long, being taken in July. The water in the inner lake is fresh, and the dates given indicate that the species may be a permanent resident, although there is an open passage to the sea.

The name applied to this fish by the local fishermen is *pla tak*.

Genus ZENARCHOPTERUS Gill

Zenarchopterus Gill, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 273, 1864. (Type, *Hemiramphus dispar* Cuvier and Valenciennes.)

The nomenclature of the species of this genus is much confused. The best account of the taxonomic and nomenclatorial questions involved is by Mohr (1926a), who gives for the 13 species recognized a valuable table, including a sketch of the dorsal and anal fins in the male of each species.

All of the members of this genus are viviparous and have secondary sexual characters in the dorsal and anal fins and also in the shape of the anal papilla.

Five species are recognized from Thailand, with the following distinguishing characters:

1*a*. Upper jaw 2 times or nearly 2 times as long as broad.
  2*a*. Projection of lower jaw beyond upper jaw 4 times length of latter; dorsal rays in male apparently unmodified; seventh anal ray in male enlarged and thickened but not produced beyond other rays______________ clarus
  2*b*. Projection of lower jaw beyond upper jaw 2 to 3 times length of latter; second to fourth dorsal rays in male enlarged and elongated; fifth and sixth or sixth and seventh anal rays in male enlarged and thickened but not extending beyond other rays_________________________ ectuntio

1b. Upper jaw as broad as long.
  3a. Projection of lower jaw beyond upper jaw 7 to 8 times length of latter.
    4a. Fifth dorsal ray in male thickened and more than twice length of other rays; sixth anal ray in male greatly enlarged and lengthened, in some examples extending to end of caudal fin........................ gilli
    4b. Fourth dorsal ray in male broadened, thickened, bowed, and in fully mature examples may be nearly 4 times length of other rays, the end club-shaped; sixth anal ray in male enlarged, thickened, and twice length of other rays.................................... dunckeri
  3b. Projection of lower jaw beyond upper jaw 6 times length of latter; dorsal rays in male unmodified; sixth anal ray in male enlarged, thickened, and moderately elongated, seventh and eighth rays slender and elongated.. pappenheimi

ZENARCHOPTERUS CLARUS Mohr

Zenarchopterus clarus Mohr, 1926a, p. 241 (Bangkok).

At the time the original description of this species was published only two females were known; these, 16.5 and 15 cm. long, were found in the Lubeck Museum and had come from Bangkok. Later in the same year Mohr (1926b) published a notice of three additional specimens found in Vienna, two of them females 15 and 15.2 cm. long, one a male 12.2 cm. long, all from Rangoon, Burma.

The differential features on which the species is based are: Length of upper jaw twice its width at base; length of lower jaw beyond the tip of the upper jaw 4 times the length of the lower jaw; dorsal rays 13 or 14, none modified in the male; anal rays 11 to 13, the middle ray in the male enlarged and thickened but not produced beyond the other rays. Various characters that would be of interest in comparing this species with related forms have not been published.

The possibility that this species is *Z. ectuntio* (Hamilton) is to be considered.

ZENARCHOPTERUS ECTUNTIO (Hamilton)

Esox ectuntio Hamilton, 1822,, pp. 212, 380 (Gangetic provinces).

Hemiramphus borneensis Bleeker, 1865 (347), p. 35 (Siam); 1865 (356), p. 176 (Siam).

Hemirhamphus amblyurus Günther, 1866, vol. 6, p. 273 (Siam).—Károli, 1882, p. 182 (Siam).

Zenarchopterus ectuntio Weber and de Beaufort, 1922, vol. 4, p. 165 (Siam).

Xenarchopterus ectuntio Hora, 1923b, p. 176 (Bangkok).

Zenarchopterus amblyurus Mohr, 1926a, p. 243, fig. 11 (Siam).

This fish is very common and has a wide distribution in Thailand. It occurs in most of the rivers of Central Thailand, ranges at least as far south as the Tale Sap in Peninsular Thailand, and has been observed in Southeastern Thailand at Krat. From its habit of swimming at the surface and actively darting about in search of food, the fish is conspicuous and easily recognized; the tip of the lower jaw is glistening white. In the Menam Chao Phya at Paknam on July 13, 1923, eight specimens were caught from a launch in a few minutes on a hookless line, to which a small particle of raw shrimp was attached.

The maximum length appears to be about 18 cm.

The exact status of the fish of the Ganges basin that Hamilton in 1822 called *Esox ectuntio* remains to be determined satisfactorily, but from the information available to the present writer he feels that the name *ectuntio* may appropriately be retained for a common Thailand species. While the original description was long, few diacritical features were brought out, and some statements were directly contradictory. In one place the lower jaw was said to be three times longer than the upper and in another place thrice as long, but in a detached highly abbreviated key the jaws were given as subequal and the body, which was elsewhere credited with large scales, was stated to be scaleless.

Bleeker (1866–72 [301], vol. 6, p. 62) recognized *ectuntio* as a *Zenarchopterus* and suggested it was identical with *Z. buffonis* (Cuvier and Valenciennes, 1846), which latter name he unwarrantedly held should apply to the species if the two forms should eventually prove to be the same. On the basis of the relative length of the jaws, *buffonis*, with the lower jaw 5.75 to 7 times as long as the upper, could not be *ectuntio*, with the lower jaw only 3 or 4 times as long as the upper. *Zenarchopterus buffonis*, rated as a distinct species by Günther, Weber and de Beaufort, Mohr, and others, has interest in the present catalog only because of its assumed identity with *ectuntio*.

Weber and de Beaufort (1922, vol. 4) recognized *Z. ectuntio* as a distinct species of wide distribution (Indo-Australian Archipelago, Singapore, Siam, Hongkong, Burma, etc.) and assigned *Z. borneensis* (Bleeker) and *Z. amblyurus* (Bleeker) to the synonymy. Characters attributed to the species of these authors are: Triangular part of upper jaw nearly twice as long as broad; length of lower jaw beyond tip of upper jaw 3 to 4 times in total length of fish; entire head 2 to 2.3 times in standard length; scales in the lateral line 48 to 50; dorsal rays 13 or 14; the second to fourth rays in the male enlarged and elongated; anal rays 10 to 12; the sixth and seventh rays in the male enlarged and thickened.

Day (1878), listing this species under the name *Hemirhamphus ectuntio*, described the upper jaw as twice as long as broad and gave a figure (plate 119, fig. 6) in which the lower jaw projects beyond the upper jaw for twice the length of the latter, thus agreeing with one of Hamilton's statements. Day recorded *H. amblyurus* and *H. borneensis* as synonyms of *H. ectuntio*.

In a valuable revision of the genus *Zenarchopterus*, Mohr (1926a) did not recognize Hamilton's *ectuntio* as a valid species. He considered it not even a hemiramphid, much less a *Zenarchopterus*, and suggested that one might regard it as a *Belone*, a genus of gars with equal jaws. Such a view does not, however, seem justified in view of Hamilton's two positive statements in the description of the species: (1) That the lower jaw is three times as long as, and (2) three times longer than, the upper.

Mohr (1926a) gave *Zenarchopterus amblyurus* full specific rank and regarded the fish that Day described and figured as *ectuntio* as the female of *Z. amblyurus*, although Day referred to the thickening of anal rays in the male. In Mohr's description of *amblyurus* and in the synoptical table of the characters of the recognized species, this form is shown to have the length of the upper jaw more or less than twice its width, the length of the lower jaw beyond the tip of the upper jaw 2 to 2.75 times the length of the latter, dorsal fin with second to fifth rays elongated in the male, and anal fin with the fifth and sixth rays enlarged and thickened in the male. The description and figure of *Z. amblyurus* given by Bleeker (301) indicate a lower jaw which projects 0.5 times the length of the upper jaw beyond the point of the latter. If the ratio of the length of the upper jaw to that of the lower jaw is of significance in this genus, as Mohr's studies would seem to indicate, two species or varieties may have been included under the name *amblyurus*.

Throughout Thailand the fish is known as *pla katung heo.*

ZENARCHOPTERUS GILLI, new name

Hemirhamphus brevirostris GÜNTHER, 1866, vol. 6, p. 274 (East Indian Archipelago).

Hemiramphus dispar VON MARTENS, 1876, p. 401 (Bangkok).

Hemirhamphus dispar SAUVAGE, 1883b, p. 151 (Menam Chao Phya).

Zenarchopterus dispar WEBER and DE BEAUFORT, 1922, vol. 4, p. 169, fig. 58 (Siam).

Zenarchopterus brevirostris MOHR, 1926a, p. 250, fig. 15 (East Indies, Singapore, Siam, Caroline Islands, Fiji Islands, Guam, Andamans, Seychelles, Madagascar, Mozambique).

This species in Thailand is known from the lower Menam Chao Phya.

The contention of Mohr (1926a) that the *Z. dispar* of Weber and de Beaufort, and of various other authors, is not the species originally called *dispar* (*Hemiramphus dispar* Cuvier and Valenciennes) seems justified. The sixth and seventh anal rays in *dispar* are greatly enlarged, thickened, and elongated, and one or both of them may extend well on the caudal fin. In *brevirostris* only the sixth anal ray is noticeably enlarged and lengthened, with a large number of subsidiary rays developed on its posterior side, and it may reach as far as the posterior end of the caudal fin; the seventh ray, however, shows a tendency to become longer and thicker than the remaining rays. In Weber and de Beaufort's account of the form called *Z. dispar*, which Mohr synonymizes with *Z. brevirostris*, it is stated that "in males the 6th and 7th ray are enormously enlarged and thickened," indicating that true *dispar* is included, although their figure, showing noteworthy enlargement of only the sixth ray, is considered by Mohr as representing *Z. brevirostris.* The two forms are otherwise very similar, both having some of the dorsal rays in the male thickened and lengthened, and both having the upper jaw and the ratio of its length to the length of the lower jaw essentially the same.

The specific name *brevirostris* is not available for the zenarchopterid fish so called by Günther, Mohr, and others. The name *Hemirhamphus brevirostris* given by Günther (1886, vol. 6, p. 274) to a new species was a pure homonym for *Hemiramphus brevirostris* Cuvier and Valenciennes (1829, vol. 2, p. 286, footnote), based on the description and plate published by Russell (1803, p. 61, fig. 177). Russell erroneously identified his fish, the *kuddera* of the Coromandel natives, with the American species *Esox brasiliensis* Linnaeus.[7]

For the fish thus left without a valid name, the name *gilli* is now proposed, in memory of Dr. Theodore Gill, who established the genus *Zenarchopterus* in 1863.

Z. gilli bears the same vernacular name (*pla katung heo*) as *Z. ectuntio.* No distinctive information has been recorded regarding its abundance, habits, and size.

ZENARCHOPTERUS DUNCKERI Mohr

Zenarchopterus dunckeri Mohr, 1926a, p. 257 (New Guinea, New Pomerania, New Mecklenburg, Amboina).—Fowler, 1937, p. 214, fig. 192 (Rayong).

The inclusion of this species in the Thailand fauna is based on a notice by Fowler of eight specimens, 7.5 to 14 cm. long, taken at Rayong, a fishing town on the coast of Southeastern Thailand. The fish is known otherwise from New Guinea, the Bismarck Archipelago, and the Dutch East Indies. According to Mohr, who described this fish in 1926, the club-shaped fourth dorsal ray in the male is greatly enlarged and elongated and may touch the back posteriorly to the fin, and the sixth anal ray is enlarged and thickened and may be two to three times as long as the adjoining rays.

A maximum length of 17.5 cm. is reported for New Guinea.

ZENARCHOPTERUS PAPPENHEIMI Mohr

Zenarchopterus pappenheimi Mohr, 1926a, p. 258, 1 fig. (Bangkok).

This species was based on specimens, found in some Berlin Museum, that had been collected in Bangkok at a time and by a person not indicated in the specific description. The material consisted of three males, 16 to 16.8 cm. long. A male, 19.3 cm. long, collected in the Andaman

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[7] Singularly enough in Cuvier and Valenciennes (1846, vol. 19, p. 32), Cuvier's *Hemiramphus brevirostris* was rejected, partly because the specific name was inappropriate, and a new species, *Hemiramphus russelli,* was described, based on Russell's *kuddera* and his plate as cited by Cuvier.

Islands in 1886 was subsequently found in a Vienna museum and was listed by Mohr (1926b). The female was unknown until Mohr (1936) described specimens, one male and one female, in the Colonial and Oversea Museum in Bremen, which had been collected in Penang in 1906.

In this fish the length of the upper jaw is equal to its width at base, and the lower jaw in front of the tip of the upper jaw is six times the length of the upper jaw. The dorsal fin, with 12 or 13 rays, has no ray modified. In the anal fin, with 11 or 12 rays, the sixth ray is very broad and elongated, the seventh and eighth rays are slender and elongated, and the remaining rays are unmodified.

Genus DERMOGENYS van Hasselt

Dermogenys VAN HASSELT, Alg. Konst. Letterbode, vol. 2, p. 131, 1823. (Type, *Dermogenys pusillus* van Hasselt.)

DERMOGENYS PUSILLUS van Hasselt

Dermogenys pusillus VAN HASSELT, 1823, p. 131 (Java).—WEBER and DE BEAUFORT, 1922, vol. 4, p. 140 (Siam).—MOHR, 1935, p. 41 (Siam).
Hemirhamphus fluviatilis KÁROLI, 1882, p. 182 (Siam).
Dermogenys SMITH, 1927d, p. 219 (Siam); 1934a, p. 82 (Siam).
Demogenys siamensis FOWLER, 1934a, p. 144, figs. 83, 84 (Chiengmai, Metang).
Dermogenys siamensis FOWLER, 1937, p. 214, fig. 191 (Bangkok, Paknam); 1939, p. 41 (Huey Yang).

This remarkable little fish, whose range includes Java, Borneo, and Sumatra, extending through the Malay Peninsula, is found throughout Thailand in quiet waters—rivers, rivulets, canals, drains, ponds, and lakes.

The fish is too small to have any food value for human beings, but by its consumption of mosquito larvae it acquires some importance to man. The chief interest in the fish arises from its viviparity and from the extraordinary combativeness of the males. The fish has a more prominent place in Thailand than in any other country to which it is native, because it is there employed in contests of endurance and strength, and because it is cultivated in order to increase its pugnacious qualities.

From early times the Thai people have had, as a national trait, the strongly developed desire to match various kinds of small animals in contests of strength and skill. Most noteworthy of these animals is the celebrated fighting fish (*Betta*). Next in importance is *Dermogenys*, which, though not less interesting from the zoological viewpoint, has been only slightly noticed in the literature of ichthyology, geography, travel, and sport.

The effects of cultivation and selective breeding have been manifested in a slight increase in the average size of the fish and in a very marked increase in the wrestling or fighting ability.

Cultivated fish have a keener inclination to attack and exhibit a technique decidedly superior to that of wild fish, but the most striking result of cultivation is the improvement in the stamina and endurance. Fish collected in open waters and kept in suitable vessels for a few days will, when brought together, struggle actively for supremacy, but their ardor is of short duration, one or both of the contestants will soon tire or lose interest, and a combat lasting more than 15 or 20 minutes would be unusual. On the other hand, cultivated fish may fight on hour after hour, and the contest is decided only when complete exhaustion overcomes one or both of them.

While the use of *Dermogenys* in matched contests began in a rather remote past, the cultivation of the fish was instituted about 1863 or 1864 and is now completely depended on for supplying candidates for pugilistic encounters.

Cultivation as now conducted for this fish in Thailand consists in the retention for breeding purposes of fish of proved stamina, the holding of them in pure water in spacious vessels, and the administration of appropriate food in sufficient quantity.

Only vessels of earthenware or other opaque material may be used for retaining the fish. Owing to inability to adapt themselves to the transparency, they break the lower jaw or otherwise injure themselves against the sides of glass vessels. Favorite receptacles are the large, wide-topped glazed or unglazed terra cotta water jars such as are to be found in every Thai household.

A wrestling match is arranged by providing a large earthenware basin three-quarters filled with clear water and introducing therein two male fish that have been kept in separate vessels. Instantly, and with great rapidity, the fish dart at each other, maybe from opposite sides of the wide basin, and grasp each other by their jaws. The usual hold is an interlocking of jaws at their base, with the long axis of the bodies at right angles, but there is considerable variety in the holds, and the outcome of a contest may be determined by the particular hold that one fish obtains at the start or seeks to reobtain after each break. Effective and disabling holds, which some individuals are observed to strive for regularly, and which place their adversaries at a decided disadvantage, come from the exercise of a peculiar knack that may result from generations of selective breeding. No holds are barred by the rules which wrestling-fish contests are held. One fish may grasp the other across the base of the jaws without interlocking, across the tip of the lower jaw, obliquely across the base of the lower jaw so that the adversary is kept on his side or back, across the eyes, across the gill covers, and from either above or below across the gill openings, so that respiration may be impaired and exhaustion be rapidly induced. Other holds that may be observed in the course of a series of contests are head on, with the lower jaw of one fish in the mouth of the other;

the grasping by one fish of the pectoral or caudal fin of the other, and the closing of the jaws either straight or obliquely across the body.

Only rarely is any injury done to either combatant. The lower jaw, perhaps inadvertently used for stabbing, may occasionally draw blood from the gills. The tip of the lower jaw may very exceptionally be broken. Very rarely one or both fishes, without having sustained any apparent injury, may die after being separated. The contest, in the great majority of cases, is ultimately decided by the ability of one fish to maintain, and, after a breakaway, to regain an advantageous hold that will cause exhaustion or affect the stamina. With evenly matched fish in a long-drawn-out struggle, determination of the victor may have to be based on points rather than on a single decisive act. Ordinarily the climax is reached when one fish shows unwillingness or inability to lock jaws with the other.

Phya Akaraja Varadhara, former Thai minister to Washington and London, on the conclusion of his long diplomatic career devoted himself for many years to the cultivation of *Dermogenys* at his Bangkok residence, and made interesting observations of the breeding, growth, and wrestling qualities of the species. One noteworthy observation, which should be confirmed by zoologists, indicated that virgin females may under certain conditions produce a limited number of young without ever having been associated with males.

The position of the ventral fins with reference to the gill openings and the base of the caudal fin seems to be subject to considerable variation. Weber and de Beaufort said of the ventrals, "their base a little nearer to caudal than to branchial openings," and Bleeker's figure (Atlas, 1866–72 [301], vol. 6, pl. 253, fig. 2) agrees with that description. The form called *Dermogenys siamensis* by Fowler, based on the more anterior insertion of the ventrals, appears to be referable to the present species. While the figure of the type of *D. siamensis*, a specimen 69 mm. long, apparently a female, from Chiengmai, shows the ventral base midway between the midbase of the caudal fin and the anterior margin of the eye, Fowler's figure of another specimen of the same form, a male 36 mm. long, from Bangkok, represents the ventral base as nearly midway between the caudal base and the gill opening.

In allusion to its long, slender lower jaw, this fish is called *pla khem* (needle fish) by the Thai. In allusion to its characteristic habit, it was dubbed wrestling fish by the present writer after search for a distinctive English name.

Order HETEROSOMATA: Soles and Flounders

This world-wide order has many genera and species in Thailand waters. All the forms that regularly inhabit fresh water belong in the families Synapturidae and Cynoglossidae, which locally have many salt-water forms also. Both these families are included in the Soleidae by Weber and de Beaufort (1929, vol. 5), while Norman (1928) places the Synapturidae in the Cynoglossidae. The arrangement here followed is that of Jordan (1923). The somewhat different treatment of this matter by various authors is of no great importance, and represents simply individual opinion as to the taxonomic value of certain characters. In the Cynoglossidae the eyes are on the left side and pectoral fins are lacking; in the Synapturidae the eyes are dextral and pectoral fins are present (although not fully developed in all examples) in one local genus and absent in the other.

There is a deep-seated and widespread belief in Thailand that the soles of the genera *Synaptura* and *Cynoglossus* attach themselves to the bottom of boats and there make musical sounds. This belief persists from generation to generation and loses little strength with the passage of the years, notwithstanding that no one has ever seen a sole attached to either a stationary or a moving boat, and no one has ever observed the fish while making musical or other sounds either in or out of the water. The basis for this belief, and the explanation of the sounds wrongly attributed to soles, were discussed at some length by the writer (1927b).

Family SYNAPTURIDAE: Soles

The two local genera are distinguished chiefly by the presence or absence of pectoral fins, as follows:

1*a*. Pectoral fins present-- Synaptura
1*b*. Pectoral fins wholly absent------------------------------------ Achiroides

Genus SYNAPTURA Cantor

Synaptura Cantor, Journ. Asiat. Soc. Bengal, vol. 18, p. 1204, 1850. (Type, *Pleuronectes commersoniani* Lacepède.)

Small right-sided soles inhabiting both salt and fresh waters. Four local fresh-water species are recognized as follows:

1*a*. Color of blind side whitish or yellowish.
  2*a*. Pectoral fins well developed, right pectoral as long as ventrals and 3 times diameter of eye; dorsal rays 61 to 65, anal rays 44 to 50; scales in lateral line 75 to 85-- orientalis
  2*b*. Pectoral fins rudimentary, right pectoral about as long as diameter of eye.
    3*a*. Dorsal rays 48, anal rays 38; scales in lateral line 54--------- harmandi
    3*b*. Dorsal rays 81 to 83, anal rays 63; scales in lateral line 110---panoides
1*b*. Color of blind side reddish brown; pectoral fins rudimentary; dorsal rays 54, anal rays 45; scales in lateral line 66------------------------------ aenea

SYNAPTURA ORIENTALIS Bloch

Pleuronectes orientalis Bloch, *in* Schneider, 1801, p. 157 (Tranquebar).
Synaptura orientalis Hora, 1923b, p. 182 (Nontaburi).—Fowler, 1935a, p. 132, figs. 79–83 (Bangkok).
Brachirus orientalis Fowler, 1937, p. 216 (Bangkok).

Of wide distribution in the Orient (such as India, East Indies, Singapore, Indo-China, China), this species is fairly common in parts of Thailand, in brackish and fresh waters. Fresh-water specimens have been collected in the inner lake of the Tale Sap (one fish 14.7 cm. long July 4, 1929), in the Tapi River above Bandon (a fish 16.8 cm. long September 20, 1923), and in various parts of the Menam Chao Phya from Paknam to Ayuthia, the largest examples being about 22 cm. long.

In six specimens from fresh waters, the lateral-line scales ranged from 77 to 85 (average 82.6), the dorsal rays numbered 58 to 67 (average 61.5), and the anal rays numbered 45 to 47 (average 46).

Common names borne by the fish in most places are *pla lin ma* and *pla lin kwai*. In the Tale Sap the name *pla pluk* is in use.

SYNAPTURA HARMANDI Sauvage

Synaptura (*Anisochirus*) *harmandi* Sauvage, 1878a, p. 94 (Mekong).

There seems to be no record for this species following the original description by Sauvage of a specimen collected in the Mekong by Harmand. The reduced number of dorsal and anal rays and of scales in the lateral line would seem to validate the species. Sauvage placed it in Günther's subgenus *Anisochirus*, characterized by having the pectoral fin on the blind side longer than that on the other side.

SYNAPTURA PANOIDES Bleeker

Synaptura panoides Bleeker, 1851 (49), p. 440 (Bandjermassing, Borneo); 1865 (347), p. 33 (Siam); 1865 (356), p. 172 (Siam).—von Martens, 1876, p. 398 (Bangkok).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Weber and de Beaufort, 1929, vol. 5, p. 174 (Siam).
Synaptura siamensis Sauvage, 1878a, p. 94 (Stung Strang, Laos).

Inhabiting the sea and the lower courses of rivers in Borneo, Sumatra, Malaya, and Thailand, this species is common in the last-named country, and besides being known from the Gulf of Siam pushes its way far inland into waters that are always fresh. Specimens have been examined from Bangkok, Nontaburi, Pakret, Koh Yai, and Ayuthia in the Menam Chao Phya; and in December 1923 specimens were collected at the head of the Menam Chao Phya near Paknampo, several hundred kilometers from the sea. The fish has been taken also from the Tapi River above Bandon in Peninsular Thailand.

A maximum length in excess of 24 cm. has been met with in Thailand, and many over 20 cm. long have been examined.

The species, with *S. orientalis*, is very well known to the river people in Central Thailand, and is the subject of the erroneous popular belief that it attaches itself to the bottom of boats and makes a musical sound.

There is a considerable variation in the number of lateral-line scales and of dorsal and anal rays in this species. This variation is illustrated in the following table of 15 specimens from the Menam Chao Phya and Menam Tapi. The scales are counted in the row above the lateral line, from the upper angle of the gill opening to the base of the caudal fin:

Record of the dorsal and anal rays and lateral line scales in 15 specimens of Synaptura panoides from the Chao Phya and Tapi Rivers, Thailand

Length (cm.)	Dorsal rays	Anal rays	Scales in lateral line	Length (cm.)	Dorsal rays	Anal rays	Scales in lateral line
7.7	82	57	99	17.8	75	56	92
12.6	69	55	95	19.0	73	54	102
13.5	69	54	94	21.1	80	60	105
14.4	75	59	97	21.4	79	60	103
15.0	76	60	96	21.4	80	61	99
17.0	69	55	92	22.0	82	61	92
17.1	80	58	105	24.2	81	61	106
17.3	73	56	92				

According to a letter from J. R. Norman, of the British Museum, *Synaptura siamensis* Sauvage, described in 1878 from Stung Strang in what was then Siamese Laos, is a synonym of *S. panoides*. Sauvage gave dorsal rays 68, anal rays 54, and lateral line scales 88.

The usual vernacular name is *pla lin kwai* (buffalo-tongue fish), but the term *pla lin ma* (dog-tongue fish) is also applied.

SYNAPTURA AENEA H. M. Smith

Figure 96

Synaptura aenea Smith, 1931a, p. 32, fig. 15 (Lopburi River).
Brachirus aeneus Fowler, 1934a, p. 145 (Chiengmai); 1937, p. 216, figs. 198–202 (Kemarat, Pitsanulok).

At the time this species was described, from the Lopburi River at Lopburi, the ancient capital of Thailand, it was known only from that locality, but it has since been found at Pitsanulok, near the mouth of the Nan River, in Central Thailand, at Kemarat on the Mekong in Eastern Thailand, and at Chiengmai on the Meping in Northern Thailand.

The largest specimens examined have been the type, 9.4 cm. long, from Lopburi and one 9.8 cm. long, which was one of eight collected in the Meping at Chiengmai by H. G. Deignan.

The pectoral fins are as described by Weber and de Beaufort (1929, vol. 5, p. 167), that is, "with a broad base, rudimentary rays and with

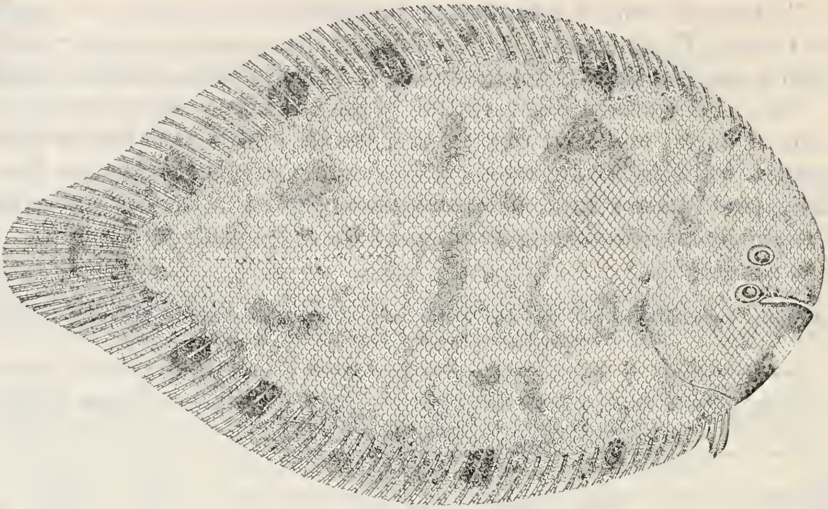


FIGURE 96.—*Synaptura aenea* H. M. Smith. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

a connection through a folded membrane with the upper part of the branchiostegal membrane."

Genus ACHIROIDES Bleeker

Achiroides BLEEKER (35) (38), Nat. Tijdschr. Nederl.-Indië, vol. 1, pp. 262, 404, 1851. (Type, *Plagusia melanorhynchus* Bleeker.)

In this genus the pectoral fins are entirely absent.

ACHIROIDES LEUCORHYNCHOS Bleeker

Achiroides leucorhynchos BLEEKER (38), 1851, p. 411 (Surakarta, Java).

Previously known only from a river in Java, this species was found in Klong Sok, an affluent of the upper Tapi, in the Bandon district of Peninsular Thailand, in December 1929 by R. Havmöller, who presented a specimen to the Siamese Bureau of Fisheries. This specimen, 7.7 cm. long, with lateral line 67, dorsal rays 54, anal rays 42, agreed fairly well with Bleeker's description and plate. In 1937 Herre and Myers recorded the species from the coast of Sumatra.

In this species the upper side has in its general brown color a white area behind and above the angle of the mouth.

Family CYNOGLOSSIDAE: Soles

Genus CYNOGLOSSUS Hamilton: Tonguefishes

Cynoglossus HAMILTON, Fishes . . . River Ganges, pp. 32, 365, 1822. (Type, *Cynoglossus lingua* Hamilton.)

All the local representatives of this family belong in the genus *Cynoglossus*, which has sometimes been split into genera or subgenera on the basis of the nostrils, whether one or two on the left side and whether, if two, one of them is placed between the eyes or both are in front of the lower eye. By far the larger number of species of the genus frequent salt or brackish waters and are never found in freshwater streams.

Fowler (1934a, 1935a, 1937) has credited to Bangkok and other communities on the lower courses of rivers in Central Thailand many strictly marine species of *Cynoglossus*, of which specimens were simply collected in the markets of those places. Among these species for which the impression might be conveyed that they have a freshwater habitat are *C. arel* (Bloch), *bilineatus* (Lacepède), *borneensis* (Bleeker), *cynoglossus*, *macrolepidotus* (Bleeker), *monopus* (Bleeker), *puncticeps* (Richards), and *semifasciatus* (Day). The only species that are known to frequent fresh water regularly are those herein listed.

All the fishes of this genus bear the vernacular name of *pla lin ma* (dog-tongue fish) in Thailand. It is noteworthy that this name is an exact translation of the Greek generic name.

1*a*. No lateral line on blind side; scales in lateral line 126 to 135; tip of rostral hook not extending beyond vertical from front margin of upper eye ---------- xiphoideus

1*b*. A lateral line on blind side; scales in lateral line 132 to 150; tip of rostral hook reaching behind vertical from posterior margin of lower eye ---------- microlepis

CYNOGLOSSUS XIPHOIDEUS Günther

Cynoglossus xiphoideus GÜNTHER, 1862, vol. 4, p. 495 (Siam); 1864, p. 179 (Siam and Cambodia).—BLEEKER, 1865 (347), p. 33 (Siam); 1865 (356), p. 173 (Siam).—HORA, 1923b, p. 182 (Nontaburi).—WEBER and DE BEAUFORT, 1929, vol. 5, p. 193 (Siam).—SMITH, 1933a, p. 83 (Menam Chao Phya).

Collections made in Thailand by the celebrated traveler Mouhot contained the specimens on which this species was based by Günther in 1862. The fish has since been found to be fairly numerous in the Menam Chao Phya as far upstream as Ayuthia, and may often be seen in the river markets, where it has some reputation as a food fish.

Examples over 20 cm. are common. The largest observed, taken at Koh Yai March 16, 1928, was 28 cm. long.

The original description of the species gave a single lateral line on the blind side, but none of the specimens examined in Thailand had any such lateral line, and according to information received from J. R. Norman the type material in the British Museum lacks a lateral line on the blind side.

A specimen 22.5 cm. long from Koh Yai had no upper eye, its position being represented simply by a socket, from which it was impossible to determine with certainty whether the lack of the eye was due to development defect or to an accident.

The vernacular names of this fish are *pla lin ma* and *pla lin kwai.*

CYNOGLOSSUS MICROLEPIS (Bleeker)

Plagusia microlepis Bleeker, 1851 (38), p. 413 (Bandjermassing, Borneo).
Cynoglossus (*Arelia*) *solum* Sauvage, 1883b, p. 151 (Menam Chao Phya).

A strictly fresh-water river fish, heretofore known only from Borneo and Sumatra, this species is recorded from Thailand on the basis of specimens taken in the Lopburi River at Lopburi, October 22, 1926, and at the head of the Menam Chao Phya at Paknampo, December 8, 1923. These specimens, 13.5 to 24.5 cm. long, conform with the descriptions as given by Bleeker and Weber and de Beaufort, although the resemblance to *C. xiphoideus* is close. The principal points of difference seem to be that in *C. microlepis* there is a single distinct lateral line on the blind side, and the number of scales in the median lateral line of the colored side averages more but the minimum number is overlapped by the maximum number in *C. xiphoideus.*

It seems likely that *Cynoglossus* (*Arelia*) *solum*, described by Sauvage in 1878 (a) from the Mekong and noticed by him in 1883 as having been collected by Harmand in the Menam Chao Phya, is the present species. It was characterized as having 3 lateral lines on the colored side, 1 lateral line on the blind side, 160 scales in the lateral line, 110 dorsal rays, and 88 anal rays, and one of the nostrils situated between the eyes (genus *Arelia* of Kaup).

Vernacular name, *pla lin ma.*

Family SYNGNATHIDAE: Pipefishes

This family, with very numerous representatives in tropical and temperate waters throughout the world, has in the fresh waters of Thailand seven species that fall into four genera, characterized below. Among the family characteristics are the encasement of the elongate body in bony plates, which correspond with the vertebrae, the elongation of the head into a tubular snout with a small terminal mouth, and the feeble development of fins. The fish live among aquatic plants, swim in a vertical position by the undulatory movements of the dorsal fin, and have extraordinary reproductive habits, the eggs being carried in a groove or pouch on the ventral surface of the male.

All the pipefishes bear in Thailand the vernacular name of *pla jim fan jorake*, meaning crocodile toothpick fish.

1*a*. Brood pouch abdominal; superior cristae of trunk and tail discontinuous.
  2*a*. Snout much longer than remainder of head; anal opening behind midlength of fish-- **Microphis**
  2*b*. Snout equal to, very slightly longer or shorter than, remainder of head; anal opening before midlength of fish------------------ **Doryichthys**

1*b*. Brood pouch subcaudal.
  3*a*. Superior cristae of trunk and tail continuous______________ Ichthyocampus
  3*b*. Superior cristae of trunk and tail discontinuous______________ Syngnathus

Genus MICROPHIS Kaup

Microphis Kaup, Arch. Naturg., vol. 19, pt. 1, p. 234, 1853. (Type, *Syngnathus deocata* Hamilton.)

The brood pouch in this genus is restricted to the abdominal region and is comparatively deep, with its sides protected by diverging plates projecting from the lower edges of the trunk shields. The small, numerous eggs occupy open cells in the swollen skin of the abdomen. Two species from Thailand are distinguished by the following characters:

1*a*. Dorsal rings 21 to 24, tail rings 34 to 40, subdorsal rings 2 to 5+6 or 7, dorsal rays 47 to 61; shields of trunk and anterior part of the tail with blue vertical bands (silvery in preservative)______________________ boaja
1*b*. Dorsal rings 17, tail rings 28, subdorsal rings 1+5, dorsal rays 30; fifth to fifteenth trunk shields with prominent black oval spots______ annandalei

MICROPHIS BOAJA (Bleeker)

Syngnathus boaja Bleeker, 1851 (26), p. 16 (Borneo).
Microphis boaja Bleeker, 1865 (356), p. 172 (Siam).—Sauvage, 1883b, p. 155 (Menam Chao Phya).—Weber and de Beaufort, 1922, vol. 4, p. 47 (Siam).—Hora, 1923b, p. 183 (Bangkok, Nontaburi).
Doryichthys boaja Peters, 1868, p. 276 (Siam).—Günther, 1870, vol. 8, p. 180 (Siam).—von Martens, 1876, p. 407 (Bangkok).

The range of the fish includes China, French Indo-China, Malaya, and various large islands in the East Indies. This is the commonest and largest of the Thailand pipefishes. Specimens have been examined from the Tale Sap and the Tale Noi, in Peninsular Thailand, and from the Menam Chao Phya at Bangkok, Nontaburi, and Ayuthia.

In the last-named region a length of 47 cm. is attained. The largest examples met with in Thailand have been 30 cm. long.

MICROPHIS ANNANDALEI Hora

Microphis annandalei Hora, 1924a, p. 472 (Tale Sap).

Known from an adult and two young collected by Dr. Annandale in the inner lake of the Tale Sap at Patalung, this species is very close to *M. boaja*, differing therefrom, according to Hora, in having fewer dorsal rays (30 as against 47 to 61), fewer trunk and tail rings (17+28 as against 21 to 24+34 to 40), and coloration. The type, 10.25 cm. long, is a male, and the young were thought by Hora to have dropped from its brood pouch. A male and a female 12 to 13 cm. long from a small brook in the town of Nakon Sritamarat, July 17, 1928, have black spots on the fifth to the thirteenth trunk rings very distinct.

Genus DORYICHTHYS Kaup

Doryichthys Kaup, Arch. Naturg., vol. 19, pt. 1, p. 233, 1853. (Type, *Doryichthys bilineatus* Heckel.)

In this genus of fresh-water and brackish-water pipefishes, the brood pouch is restricted to the abdominal region and the rather large eggs, occupying cells in the skin, are protected but not covered by broad plates converging from the sides of the pouch.

Two species have been recorded from local fresh waters as follows:

1*a*. Rings 15 to 17+33 to 38; operculum with a complete longitudinal keel with diverging ridges; snout equal to or less than remaining part of head; eye 4.5 to 5.5 in head, 2.3 to 2.75 in snout________________________ martensii

1*b*. Rings 17 to 20+31 to 35; operculum with a complete longitudinal keel without diverging ridges; snout longer than remaining part of head; eye 6.5 to 7 in head, 4 in snout________________________________ deokhatoides

DORYICHTHYS MARTENSII (Peters)

Syngnathus martensii Peters, 1869b, p. 459.
Doryichthys brachyrhynchops Fowler, 1934a, p. 145, figs. 119, 120 (Chantabun).

This species, of strictly fresh-water habitat, has previously been known from Borneo, Sumatra, and Malaya.

Its maximum length is about 12.5 cm.

It seems probable that *Doryichthys brachyrhynchops* does not differ from *D. martensii*, to which Fowler says it is closely related. The assumed differences are of such a minor character that, where actually existent, they can hardly constitute specific distinctness. Thus, while Weber and de Beaufort state for *D. martensii* that the snout equals the remaining part of the head, Fowler gives the snout as going $2\frac{1}{10}$ to $2\frac{1}{8}$ times in head and his figure shows the snout as practically 2 in head; whereas the eye in *martensii* is described as going "about 4.5 times in head, about 2.3 times snout," the eye in *brachyrhynchops* is given as $5\frac{1}{4}$ to $5\frac{1}{2}$ in head and $2\frac{2}{3}$ to $2\frac{3}{4}$ in snout, but according to the published figure the eye goes approximately 4 in head and 2 in snout; and the length of caudal fin, given by Weber and de Beaufort as twice as long as eye, is stated by Fowler that it "appears to exceed $1\frac{1}{2}$ times eye," but his figure definitely shows the caudal fin as $\frac{2}{3}$ of eye.

DORYICHTHYS DEOKHATOIDES (Bleeker)

Syngnathus deokhatoides Bleeker, 1853 (89), p. 17 (Palembang, Sumatra; Pontianak, Borneo).
Doryichthys deokhatoides Hora, 1924a, p. 474 (Tale Sap).

As this species was known from fresh waters in the southern part of the Malay Peninsula, as well as from Borneo and Sumatra, its occurrence in the Thailand part of the Malay Peninsula was to be expected. Hora records a single specimen collected by Dr. Annandale in the inner lake of the Tale Sap at Lampam.

The fish reaches a length of 17.5 cm.

Genus ICHTHYOCAMPUS Kaup

Ichthyocampus KAUP, Arch. Naturg., vol. 19, pt. 1, p. 231, 1853. (Type, *Ichthyocampus belcheri* Kaup.)

ICHTHYOCAMPUS CARCE (Hamilton)

Syngnathus carce HAMILTON, 1822, p. 13 (Ganges).
Ichthyocampus carce SMITH, 1933a, p. 84 (Meklong and Bangpakong Rivers).

There is no record of the finding of this species in Thailand prior to the collections made for the Siamese Bureau of Fisheries, but as the fish is known from Malaya as well as from Sumatra, Java, Bali, Celebes, India, and Ceylon, its local occurrence is not unexpected. The first specimen taken in local waters came from the Meklong on June 12, 1927, and was brought in by Luang Praserth Aksorn, of the Bureau. It was a male, 13.5 cm. long, with young in its pouch. Other specimens examined came from the Bangpakong River on June 4, 1928, and June 27, 1933. Two specimens on the latter date were males 10.1 and 11.2 cm. long, the larger having eggs in the pouch.

In this genus the brood pouch is restricted to the under side of the tail, and the eggs, occupying cutaneous cells in the skin, are completely enclosed by lateral folds, which may contain osseous plates.

Genus SYNGNATHUS Linnaeus

Syngnathus LINNAEUS, Systema naturae, ed. 10, p. 336, 1758. (Type, *Syngnathus acus* Linnaeus.)

In this genus, most of whose numerous members live in salt water, there are two species that have been found in the fresh waters of Thailand. The brood pouch is restricted to the anterior half of the tail. The eggs, deposited in individual cutaneous cells, are completely covered by folds of skin, which may contain bony plates. For the release of the young the pouch splits lengthwise. The two species from Thailand may be distinguished as follows:

1*a*. Snout definitely longer than postorbital part of head; eye 6 to 7 in head; ventral part of trunk with 13 to 15 narrow white cross bars separated by broader black cross bars ---------- spicifer

1*b*. Snout equal to, or slightly longer or shorter than, postorbital part of head; eye 4 to 5 in head; trunk without cross bars; 3 black stripes radiating from eye ---------- djarong

SYNGNATHUS SPICIFER Rüppell

Syngnathus spicifer RÜPPELL, 1840, p. 143, pl. 33, fig. 4 (Abyssinia).—SMITH, 1933a, p. 84 (Chantabun River).—FOWLER, 1935a, p. 133 (Paknam).

This species of the Indo-Australian Archipelago, Malaya, India, East Africa, China, Philippines, and various Pacific islands, seems to live indifferently in the sea, in brackish estuaries, and in fresh-water streams.

The Thailand records are two fish, 9.4 and 11 cm. long, from the Menam Chao Phya at Paknam, reported by Fowler; one fish, 16 cm. long, from the Chantabun River at Chantabun, collected by Luang Masya in August 1927; and one taken in salt water at Sriracha, Southeastern Thailand, June 14, 1927. This was a male, 13.4 cm. long, with the brood pouch full of young.

SYNGNATHUS DJARONG Bleeker

Syngnathus djarong Bleeker, 1853 (89), p. 22 (Panimbang, Java).—Fowler, 1935a, p. 133 (Bangkok); 1937, p. 219, fig. 196 (Bangkok).

This species is distributed widely through the Indo-Australian Archipelago, New South Wales, the Philippines, and Ceylon. While it occurs in brackish water, it also frequents fresh-water brooks and ponds, and it is known from Thailand by two specimens, 9 and 12.2 cm. long, from the Menam Chao Phya at Bangkok.

Order LABYRINTHICI: Labyrinth Fishes

Family ANABANTIDAE

The anabantids are among the most interesting and outstanding of the fresh-water fishes of Thailand. They present a wide range in shape, size, and coloration, but have as a characteristic feature the possession of an accessory respiratory organ, situated in a cavity above the gills, by means of which oxygen may be taken directly from the atmosphere. While the gills are functional, they appear inadequate to sustain life, and all the numerous members of the family living in Thailand are partly dependent on atmospheric air, which they take in through the mouth.

Associated with the air-breathing habit is the blowing by the male fish of air-bubbles which form into clusters at the surface and serve as nests in which the eggs are laid and hatched. A mucous secretion from the buccal cavity strengthens the bubble walls.

This family in Thailand has 10 members belonging in 6 very distinct genera, as follows:

1*a*. Origin of dorsal fin over or slightly in advance of base of pectorals; dorsal fin longer than anal; ventral fins with a spine and 5 soft rays, none of which is produced into a filament.
  2*a*. Fixed conical teeth in jaws; a band of teeth on vomer; mouth rather large, oblique, nonprotractile, cleft extending to or beyond edge of orbit; opercle and preopercle serrated; dorsal soft rays 7 to 11; anal soft rays 8 to 12 ---------- Anabas
  2*b*. No teeth in jaws, movable teeth on lips; no teeth on vomer; mouth small, horizontal, protractile, cleft extending about halfway to orbit; opercle and preopercle entire; dorsal soft rays 13 to 16, anal soft rays 17 to 19 ---------- Helostoma

1*b*. Origin of dorsal fin far behind base of pectorals; dorsals fin shorter than anal; ventral fins with first soft ray produced into a filament.
  3*a*. Ventral fins with a well-developed spine.
    4*a*. Lateral line complete; first of 5 soft ventral rays produced into a very long articulated filament; size large__________________ Osphronemus
    4*b*. Lateral line absent or vestigial; first of 5 soft ventral rays more or less produced into a filament; size very small.
      5*a*. Preorbital serrate; dorsal spines II–VI, anal spines IV–VIII. Trichopsis
      5*b*. Preorbital entire; a single dorsal spine, anal spines I to IV_____ Betta
  3*b*. Ventral fins with a vestigial spine and 3 or 4 rays, the first ray produced into a very long unarticulated filament; lateral line present. Trichogaster

Genus ANABAS Cuvier and Cloquet

Anabas Cuvier and Cloquet, Dictionnaire des sciences naturelles, ed. 2, vol. 2, suppl., p. 35, 1816. (Type, *Perca scandens* Daldorff.)

ANABAS TESTUDINEUS (Bloch)

Anthias testudineus Bloch, 1792, vol. 6, p. 121 (Japan).
Anabas scandens Bleeker, 1865 (356), p. 173 (Siam).—Sauvage, 1881, p. 159 (Siam).—Káróli, 1882, p. 172 (Siam).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Smith, 1930, p. 58 (Siam).
Anabas scandens von Martens, 1876, p. 394 (Bangkok).
Anabas macrocephalus Káróli, 1882, p. 172 (Siam).
Anabas testudineus Peters, 1868, p. 259 (Menam Chao Phya).—Weber and de Beaufort, 1922, vol. 4, p. 334 (Siam).—Hora, 1923b, p. 181 (Bangkok).—Vipulya, 1923, p. 224 (Bangkok).—Hora, 1924a, p. 483 (inner lake, Tale Sap).—Fowler, 1934a, p. 146 (Hua Mak, Chiengmai); 1935a, p. 137 (Bangkok).—Smith, 1936a, p. 249 (Siam).—Fowler, 1937, p. 222 (Tachin, Pitsanulok, Mepoon).

This is the celebrated walking fish or climbing perch, whose habitat covers south China, French Indo-China, Thailand, Malaya, Burma, India, Ceylon, Philippine Islands, and the Indo-Australian Archipelago. In Thailand the distribution is wide, extending from the extreme north to southern part of the Peninsula and from the Mekong to the Salwin.

A length somewhat in excess of 23 cm. is attained, but full maturity is reached in Thailand when the fish is 10 to 15 cm. long.

The fish lives in all kinds of fresh water, including large streams, but flourishes most in canals, ditches, lakes, ponds, and swamps. By means of its supplementary breathing apparatus, it can thrive in water deficient in oxygen, and has, in fact, ceased to depend entirely on its gills for its respiratory requirements. Associated with the air-breathing function is the habit of deliberately leaving the water and going considerable distances on dry land. Progress is jerky and ungraceful and is accomplished by lateral movements of the tail while the fish maintains an upright position supported by the spread paired fins.

The fish is very hardy and able to live out of water for protracted periods, depending on the moisture of the air-breathing parts. In Thailand, where *Anabas* is an important and staple food fish over the whole country, it is the custom to take it to market in wicker baskets or in tubs with little or no water and to expose it for sale out of water on wooden or stone slabs, and the only attention during a long day in the market may be infrequent sprinkling with water.

In view of the widespread public interest in this fish, it may be appropriate to give the following somewhat detailed account of its history, habits, and special structures, as abstracted and adapted from an article by the present writer published in 1936.

In 1791 a Dane named Daldorff, while in Tranquebar, at that time a Danish possession in India, came upon a fish which, during a heavy rainfall, was climbing a Palmyra palm and had reached a point 5 feet above the ground. There it was apparently enjoying itself in a little stream running in a fissure in the palm's trunk from a broad frond, which collected the rain water as in a funnel. Nearby was a swamp from which the fish had probably come.

Daldorff published his observations in the Transactions of the Linnaean Society of London 1797 and described the fish as a new species under the name *Perca scandens*, or climbing perch. He was the first European to give an account of the live fish, but the species had already received the name *testudineus* (in reference to its hard covering like a turtle shell) by the German zoologist Bloch in 1795, so the significant name applied by Daldorff had to yield to the law of priority.

The name "climbing perch" by which the fish has generally come to be known among English-speaking people and in English works of reference is somewhat inappropriate. The fish is not a perch and is not even remotely related to the true perches, common fresh-water fishes of America, Europe, and northern Asia. The generic name *Perca* first borne by the fish had no nomenclatorial standing, and in 1817 the fish was brought by Cuvier under the new generic name *Anabas*, or climber, and became the type of the oriental family Anabantidae, which includes such well-known species as the diminutive paradise fish, the Siamese fighting fish, and the giant goramy.

Other common names by which this fish has been called are "climbing fish" and "walking fish," but these are borne also by several gobies, catfishes, serpent-head fishes, and others. On the whole, it may be best to adopt the perfectly distinctive generic name as the common designation of the fish in European languages and call it *Anabas*.

The blunt head is very hard and the gill covers are bordered with backwardly projecting spines. The body is enclosed in a thick, tough coat covered with hard overlapping scales, which are edged with spinules. The dorsal and anal fins contain sharp spiny rays. The thick skin retards the loss of moisture from the tissues when the fish is out of the water, and the spinous armament discourages or altogether prevents the attacks of water and land snakes, water lizards, birds, and other fishes. The small, conical teeth are in bands in each jaw, and are adapted for crushing insects, shrimps, and snails, which constitute a large part of the food.

There are gills such as ordinary fishes possess, but the gills in the long process of evolution have become less important and now seem quite inadequate to sustain life. This is easily shown by putting a fish in an aquarium with a wire-mesh screen just below the surface. With inability to take in atmospheric air, the fish begins to suffer and will soon die. The reduced gills represent only a small proportion of the total respiratory surface, and the major part of respiration is carried on by means of a special structure occupying a cavity over the gills and consisting of a series of thin, concentrically arranged bony plates covered by a vascular mucous membrane, which enables the fish to absorb atmospheric oxygen. Some writers have apparently failed to appreciate the exact role of the accessory branchial organ in *Anabas*. Thus, Dr. Francis Day, who spent many years in India and Burma and published a monumental work on the fishes of those countries, stated that the "hollow superbranchial organ * * * enables the climbing perch to retain water for a considerable time, so that it can moisten its gills and live whilst out of its native element." This enables the fish to breathe atmospheric air when the gills cannot be used. The gills function only when the fish is submerged; the superbranchial organ functions only when the fish is out of the water.

In the Dravidian language of Ceylon and India and in some Malayan dialects the name for *Anabas* means a tree climber, but the tree-climbing powers of the fish have been viewed with doubt or altogether denied by some of the leading ichthyologists of India. There is no reason why *Anabas* should climb trees as a regular habit, and in my rather extensive acquaintance with the fish in India, Burma, Ceylon, Siam, French Indo-China, Malaya, the Philippines, and some of the Indo-Australian islands I have never known one to climb a tree or to be found in a tree except at its base. But from what I know of the out-of-water movements of this fish I would have no difficulty or hesitation in accepting Daldorff's statement. A Palmyra palm, with its rough bark and its fronds beginning near the ground, would be no more formidable for an *Anabas* to ascend than would be the vertical side of a wicker basket. For a fish that for weeks or months may have been suffering from a deficiency of water, a stream of rain water flowing down an inclined palm trunk would have strong appeal.

The climbing powers of *Anabas* are exercised chiefly in leaving its home in a pond, swamp, or canal and seeking other waters that may afford better living conditions. In making this change of quarters the fish may have to travel on dry land, and it is this habit that is characteristic and well known to oriental people. In Siam, I not infrequently came upon an *Anabas*, usually at night, crossing a dusty road or traversing a dry lawn or field. It was easy to discover the water that a fish was leaving but it was not always possible to determine the particular water to which it was heading. In some cases the body of water to which the fish was obviously bound did not seem to the human observer to be more attractive than the water that had been left. The banks of drying canals and ponds, up which the fish has to climb, may be high and steep, and skill and patience may be required to negotiate them; but on arriving at a new body of water the fish may exercise much less care in descending, and I occasionally saw one, apparently deliberately, roll or fall down a steep bank and go into the water with a splash.

As would be expected in a fish that regularly leaves the water and travels overland, *Anabas* displays no conspicuous color that might attract attention. The adult fish is of a uniform dark brown while the young is light brown, with a few blackish transverse stripes.

The walking powers of *Anabas* seem to be exercised only when it is in quest of a new aquatic environment, and there appear to be no observations indicating that the fish feeds regularly when out of the water, although it may conceivably seize insects or worms that happen to be in its terrestrial path.

The walking movements lack the grace and ease of those of a lizard and some of the gobies, such as the mudskipper (*Periophthalmus*). The gait is jerky but comparatively fast, and the efforts are usually persistent, so that a fish may travel a considerable distance in a short time. I have a note on the actually observed out-of-water movements of an *Anabas* in Peninsular Siam. This fish had been living in a small pool in a detached circular garden thickly planted with flowers and shrubs, but was removed when the pool was to be cleaned. It was taken by a servant for release in a stream on the edge of the compound. The servant, however, was called away and he put down the basket containing the fish just before reaching the stream. The fish immediately climbed out and, instead of entering the nearby stream, headed back in the direction of the pool. Its subsequent movements were partly conjectured but were under observation during the latter half of the journey. The fish first passed through grass and then over a metaled driveway between houses; and on arriving at the garden it continued on the driveway to the far side and then made a short turn, plunged through the flower beds, and reentered the pool. The distance traveled was about 300 feet and the time occupied was about 30 minutes. This particular fish, in addition to progressing readily on dry land and breathing atmospheric air, had well-developed aerial vision (which is rare in fishes) and seemed to exhibit a homing instinct.

Anabas is a valuable food fish in India, Burma, Siam, Malaya, China, and the islands lying off the southeast coast of Asia. Its importance to man arises from the inherent edible quality of its flesh, from the adaptability of the fish to almost any kind of water, and from its hardiness, which permits easy handling in commerce.

Young Siamese anglers sometimes insert the head of a newly caught *Anabas* between their teeth so as to leave both hands free to rebait and recast the line, while in India fishermen often kill their catch by putting the fish in their mouths and biting the backbone just behind the head. On rare occasions this practice has led to dire consequences, for the fish has given a jerk, wriggled into the back of the angler's mouth, and become lodged in the pharynx, from which extraction is almost impossible owing to the strong backward-projecting spines on the sides of the head. When in India I learned of several deaths from suffocation when *Anabas* became tightly impacted over the windpipe of fishermen, and Dr. E. W. Gudger, of the American Museum of Natural History, has published accounts of these and many other cases in which oriental children and adults have been killed by having live fish wedged in the pharynx.

Over most of Thailand this fish is known as *pla mor* (doctor fish), sometimes, as in the Bangkok region, amplified to *pla mor thai.* In parts of Northern Thailand the Lao name *pla sadet* is in common use.

Genus HELOSTOMA Kuhl and van Hasselt

Helostoma Kuhl and van Hasselt, *in* Cuvier, Le règne animal, ed. 2, vol. 2, p. 228, 1829. (Type, *Helostoma temminckii* Cuvier and Valenciennes.)

HELOSTOMA TEMMINCKII Cuvier and Valenciennes

Helostoma temminckii Cuvier and Valenciennes, 1831, vol. 7, p. 342 (Java).—Bleeker, 1859-60 (239), p. 101 (Siam).—Sauvage, 1881, p. 160 (Siam); 1883b, p. 151 (Menam Chao Phya).

Helostoma temmincki Bleeker, 1865 (356), p. 173 (Siam).—Weber and de Beaufort, 1922, vol. 4, p. 340 (Siam).

Helostoma Smith, 1925, p. 59 (Siam).

From Java, Borneo, and Sumatra the range of this species extends through the Malay Peninsula well into Central Thailand. While found in sluggish streams, it is essentially a fish of swamps, ponds, and lakes, and in Thailand it is known particularly from the Tale Noi, near the Tale Sap, and other sluggish waters in the Peninsula, and from Bung Borapet in Central Thailand.

A length of 30 cm. is reached. The largest actually measured in Thailand was 25.5 cm. over all. Several specimens, 21 cm. long, obtained at Nakon Sritamarat October 19, 1923, were ripe males.

Fish as long as 10 or 12 cm. from Bung Borapet proved very attractive in small balanced aquaria in Bangkok. The general bright silvery skin is relieved by vertical black bars on the head, black longitudinal stripes on the body following the rows of scales, a black vertical band at the base of the caudal fin, and black spinous dorsal and anal fins. They were hardy and quickly adapted themselves to aquarium life, feeding on small bits of raw fish, insects, and shrimps.

In different parts of its range in Thailand this fish bears different vernacular names not applied to other species. In the region of vast lakes and swamps about the head of the Menam Chao Phya and the lower Menam Nan in Central Thailand it is variously called *pla ikoh*, *pla itan*, *pla mor tan*, and *pla bai tan*. In Nakon Sritamarat and other parts of Peninsular Siam the name commonly in use is *pla wee* or *wi*.

Genus OSPHRONEMUS Lacepède

Osphronemus Lacepède, Histoire naturelle des poissons, vol. 3, p. 116, 1802. (Type, *Osphronemus goramy* Lacepède.)

OSPHRONEMUS GORAMY Lacepède

Osphroneme goramy Lacepède, 1802, vol. 3, pp. 116, 117 (France).
Osphromenus olfax Bleeker, 1859–60 (239), p. 101 (Siam); 1865 (356), p. 173 (Siam).—von Martens, 1876, p. 394 (Bangkok).—Károli, 1882, p. 172 (Siam).—Boulenger, 1903, p. 303 (Patani River).
Osphronemus olfax Sauvage, 1881, p. 160 (Siam).
Osphronemus goramy Weber and de Beaufort, 1922, vol. 4, p. 344 (Siam).—Smith, 1930, p. 59 (Siam); 1933c, p. 276 (Siam).

The original habitat of this species is usually given as Java, Borneo, Sumatra, and other East Indian islands. Lacepède (1802) stated it was indigenous to China, but it has been naturalized in India and various other parts of the world, and in some Oriental countries the transplanting may have begun at an early date, so that it is now difficult, if not impossible, to decide with certainty whether the fish is native or introduced. This is true of Thailand. The fish is so hardy and bears transportation so readily that it could easily have been taken into Thailand from Sumatra, Borneo, or Java. There is, however, no available history of such introduction, and there is no record for Thailand, as there is of Java, of the cultivation of the fish in ponds, although in south-central Thailand the goramy has been kept for many years and attained a large size in ponds in the compounds of certain Buddhist temples.

The *goramy* occurs in open waters in tributaries of the Menam Chao Phya in Central Thailand and the Tapi River and the Inland Sea in Peninsular Thailand. The most abundant supply is in the Tapi River, and especially in its lakelike expansion known as Khun Tale some distance above the town of Bandon. Specimens seined there in September 1923 were 33 to 47 cm. long; a definite record of 56 cm. was obtained for a fish taken in September 1924, and the local fishermen report a maximum length of 60 cm.

The reputation that this fish has as food in other parts of its natural and extended range is not borne in Thailand, where the flesh is considered of somewhat rank flavor. Cultivation in suitable ponds, with selected food, would no doubt improve its comestible qualities, and the fish has been strongly recommended for pond culture in Thailand.

It is interesting to note, as bearing on the question whether this species was indigenous to Thailand, that the vernacular name gourami applied to this fish in the East Indies has not been adopted in Thailand, even in the parts largely populated by Malays. The names given by the Thai are *pla min* in the Peninsula and *pla raet* (rhinoceros fish) in the Central area. Sauvage (1881) attributed to Dr. Bocourt the following note in regard to *Osphronemus olfax* in Thailand: "Ce poisson, dont la chair est très délicate, est désigné à Siam sous le nom pla-duk." This is in error; *pla duk* is the Thai name for catfishes of the genus *Clarias* and has never been applied to any other fishes.

Genus TRICHOPSIS Kner

Trichopsis KNER, *in* Canestrini, Verh. zool.-bot. Ges. Wien, vol. 10, Abh., pp. 702, 708, 1860. (Type, *Trichopsis striatus* Bleeker.)

TRICHOPSIS VITTATUS (Cuvier and Valenciennes)

FIGURE 97

Osphromenus vittatus CUVIER and VALENCIENNES, 1831, vol. 7, p. 387 (Java).

Trichopus striatus BLEEKER, 1859–60 (239), p. 101 (Siam).—SAUVAGE, 1881, p. 160 (Siam).

Osphromenus striatus GÜNTHER, 1861, vol. 3, p. 386 (Siam, local variety).—BLEEKER, 1865 (347), p. 34 (Siam); 1865 (356), p. 173 (Siam).—KÁROLI, 1882, p. 172 (Siam).

Ctenops vittatus REGAN, 1910, p. 776 (Siam).—WEBER and DE BEAUFORT, 1922, vol. 4, 351 (Siam).—HORA, 1923b, p. 182 (Bangkok); 1924a, p. 482 (inner and outer lakes, Tale Sap).

Trichopsis harrisi FOWLER, 1934b, p. 348, figs. 11, 12 (Krat); 1937, p. 222 (Bangkok).

Trichopsis vittatus FOWLER, 1937, p. 222 (Mepoon).

The range of this species includes Java, Borneo, Sumatra, Malaya, Indo-China, and Thailand. It is found throughout Central, Peninsular, and Southeastern Thailand, but definite records for Northern and Eastern regions seem to be lacking. It abounds in small weedy streams, and is often found in company with *Betta*. In Southeastern Thailand it occurs in brooks on Kao Sabap at an elevation of 2,000 feet. In January 1926 young specimens were collected by the writer in a pond in the grounds of the celebrated temple of Angkor Wat in Cambodia.

The maximum length attained in Trailand is about 6.5 cm.

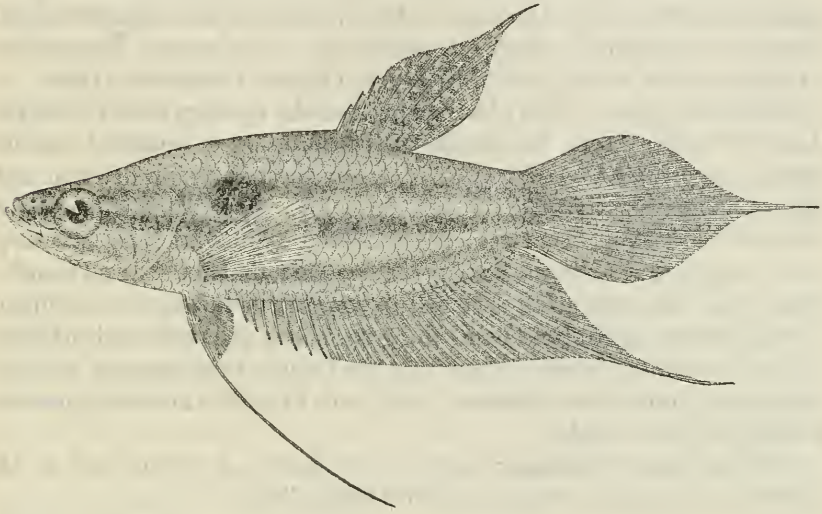


Figure 97.—*Trichopsis vittatus* (Cuvier and Valenciennes). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

The species is subject to considerable variations in color, even in examples from the same locality. Günther (1861, vol. 3) noted in two specimens collected in Thailand by Mouhot a difference in coloration from that shown in fishes from Java and Borneo: the Thailand fishes having three blackish longitudinal bands with a round black spot at or near the shoulder in the uppermost band, as against two brown longitudinal bands in Javanese fish and four black longitudinal bands in specimens from Borneo. A numerous lot of adult and young specimens from a canal in Bangkok, May 1934, showed the three blackish longitudinal bands, which are the normal in Thailand fish, with some of the adults having a distinct black shoulder spot and others no such spot. Dissections made by Dr. Leonard P. Schultz indicate that this spot characterizes the males.

T. vittatus is an attractive and hardy aquarium fish, and it has become popular in occidental countries. In Thailand it was less active and more reserved than *Betta*, often refusing food when *Betta* would take it, but it was a determined pursuer of mosquito larvae. Like

Betta, it needs to take in atmospheric air at frequent intervals. A dozen to 20 fishes in a balanced aquarium in Bangkok regularly moved as one fish in rapid excursions to the surface and back again to the bottom.

The fish makes a high-pitched croaking sound, and in aquarium literature has come to bear the name of croaking gourami. In Thailand the males are sometimes made to fight like *Betta*, but the action is much less spirited and less sustained than with the fighting fish.

This species, for many years called *Ctenops vittatus*, has been pronounced by Myers (in Herre and Myers, 1937) as not congeneric with *Ctenops nobilis* McClelland, the orthotype of the genus. The earliest available name seems to be *Trichopsis* (Kner) Canestrini, 1860.

Herre and Myers (1937) have expressed the opinion that *Trichopsis harrisi* Fowler from Southeastern Thailand is a doubtful species. Fowler separated *harrisi* from *vittatus* on the possession of eight anal spines as against six or seven and on color. Specimens in the U. S. National Museum, from widely separated points in Thailand representing typical *vittatus*, have seven or eight anal spines, and some of them show the coloration ascribed to *harrisi*, including the extension of the lowest longitudinal band along the cheek and under side of head. It is believed that *harrisi* falls within the limits of variation of *vittatus*. It may be noted that Günther (1861, vol. 3) gave the anal spines as numbering six to eight.

The common vernacular name is *pla krim*. A name used in the Chantabun region is *pla kat pa* (wild biting fish).

Genus BETTA Bleeker: Fightingfishes

Betta Bleeker (25), Verh. Batav. Genootsch. (Ichth. fauna Java), vol. 23, p. 14, 1850. (Type, *Betta trifasciata* Bleeker.)

Most of the dozen or more species of *Betta* inhabit Borneo, Sumatra, and Java and several occur in Malaya. Only two closely related forms have been found as far north as Thailand, as follows:

1*a*. Head broad; interorbital space wide and flat; anal rays II, 20 to 25; caudal rays produced; back bluish black, sides light brown, belly whitish; 2 or 3 blackish longitudinal bands, one from snout to base of caudal, one from under eye across opercle and thence along base of anal fin, one (often indistinct in life) from upper edge of eye to upper part of caudal peduncle; gill membranes light colored; dorsal fin light brown, with obscure lines of dark spots; caudal and anal fins brown; ventral and pectoral fins whitish-- taeniata

1*b*. Head less broad; interorbital space narrow and convex; anal rays II to IV, 21 to 24; caudal rays not produced; dark greenish above, red below, scales dark edged; a dark oblique stripe from eye to subopercle; sometimes 2 dark longitudinal bands from eye to base of caudal; gill membranes blackish; rays of dorsal fin dark, membranes green with dark undulating stripes; caudal rays red, membranes green; anal and ventrals red; pectorals pale-- splendens

BETTA TAENIATA Regan

? *Betta trifasciata* KÁROLI, 1882, p. 172 (Siam).
Betta taeniata REGAN, 1910, p. 781, pl. 78, fig. 1 (River Senah, Sarawak).—SMITH, 1929, p. 12 (Nakon Sritamarat, Chantabun).—MASYA and INDRAMBARYA, 1932, p. 279 (Koh Samui).
? *Betta macrophthalma* FOWLER, 1934a, p. 146 (Chatabun).

Originally described from Sarawak, Borneo, and later ascertained to be an inhabitant of Sumatra also, this species was added to the Thailand fauna in 1928, when specimens were collected in such widely separated localities as Nakon Sritamarat in the Peninsula and Chantabun in the Southeastern area. A specimen from the former place was sent to the British Museum and compared with Regan's types by J. R. Norman, who reported that the differences were such as would fall within the limits of variation. In 1931 the fish was collected on Koh Samui, a large island in the Gulf of Siam off the Malay Peninsula. More recently Herre and Myers (1937) have reported the species as "common all through the Malay States."

The maximum length seems to be somewhat in excess of 8 cm.

In Klong Nakon Noi, a clear, weedy brook flowing through the town of Nakon Sritamarat, this species was found to be common in July 1928, in association with *Trichopsis*, *Trichogaster*, *Nandus*, *Rasbora*, and *Aplocheilus.* The fish has a superficial resemblance to *Trichopsis*, but the body is stouter, the snout is shorter and broader, and the caudal fin is rounded. In a mountain brook at Ban Ang, on Kao Sabap, Southeastern Thailand, a number of specimens were taken in company with *Trichopsis.*

Life colors of fish from Nakon Sritamarat, July 1928: Back bluish black; two dark longitudinal bands, one from snout, through eye, to base of caudal, one from under eye, across opercle, thence along base of anal fin; a third band, from upper edge of eye to upper part of caudal peduncle, scarcely visible in life but appearing in alcohol; belly white; cheek and lower opercle flecked with white; all scales of cheeks, lower opercle, under side of head, and lower side as far as anal fin with minute, round, whitish spots; dorsal fin light brown, with obscure lines of dark spots; caudal and anal fins brown; ventrals and pectorals whitish.

It is believed that Fowler's record of *Betta macrophthalma* for Southeastern Thailand should be credited to *Betta taeniata.* Weber and de Beaufort (1922, vol. 4) consider *macrophthalma* a synonym of *picta*, which is similar to *taeniata* in general appearance but has only a single spine in the anal fin, while for his material Fowler gives two spines as in *taeniata.*

The local vernacular name is *pla krim hua mong* (big-head krim fish).

BETTA SPLENDENS Regan

Betta splendens Regan, 1910, p. 782 (Siam).—Myers, 1926, p. 97 (Siam).—Smith, 1927a, p. 126 (Siam); 1927d, p. 217 (Siam); 1930, p. 60 (Siam).—Choola, 1930, p. 91 (Siam).—Smith, 1932b, p. 181 (Siam).—Fowler, 1934a, p. 146 (Cheingmai, Metang River); 1935a, p. 137 (Bangkok).—Smith, 1937b, p. 264, pl. (Siam).

Betta pugnax Bleeker, 1865 (356), p. 173 (Siam).—von Martens, 1876, p. 395 (Bangkok).—Sauvage, 1881, p. 160 (Siam).

This, the celebrated fightingfish of Thailand, has a wide natural distribution in ponds, ditches, drains, and sluggish waters generally throughout the country. It does not appear to have been indigenous to any other country, but it is now to be found around the world because of its attractiveness, hardiness, and adaptability to small aquariums.

The maximum length of wild fish is about 5 cm. for males, females being somewhat smaller. A length of 6 to 6.5 cm. is attained by male fish bred in captivity.

Earlier references to this species were usually under the name of *Betta pugnax* (Cantor). It remained for Regan in 1910 to point out that *B. pugnax* is native to the island of Pinang and that the Thailand form is distinct.

For several hundred years the fish has been used locally for sporting purposes, and for more than 90 years it has been domesticated and cultivated. Cultivation has increased the size, improved the colors, and enhanced the fighting qualities.

The habits, cultivation, and fighting of this fish are the subjects of a rather voluminous literature. Accounts based on first-hand information and personal observations and experience have been published by the present writer (1937a, 1937b). From the latter account the following statements have been abstracted:

> In a wild state the fighting fish is an inconspicuous, retiring little creature, seeking protection from the glare of the sun's rays and from fish-eating birds like egrets, herons, and kingfishers by hiding beneath and among water plants.
>
> The general coloration of a quiescent fish is dull grayish brown or green with or without obscure dark lateral bands, and conveys no suggestion of the wonderfully brilliant hues assumed by the male under proper stimulation. Under the stress of excitement the male fish exhibits a remarkable change. All the fins are widely spread, the gill membranes are expanded and project like a frill or ruff suggestive of the raised hackles of fighting cocks, and the entire body and fins become intensely suffused with a lustrous blue or red color, which makes the fighting fish one of the most beautiful of all fresh-water fishes. The normal incitement to the display of latent colors is the approach of another male, but the same effect is produced when a fish sees his reflection in a mirror.
>
> Observations on fishes kept under the most favorable conditions in aquaria indicate that this species is normally short-lived. Possibly as a result of its strenuous activity and rapid metabolism, possibly because its span of life is predetermined by some immutable hereditary requirement, the fish in Siam appears to reach its age limit in 2 years, but under domestication in colder climates a somewhat greater age may be attained.

The common human custom of making animals compete among themselves for individual supremacy, and of laying wagers on the outcome of the contests, has, among the Siamese, been directed particularly to fish. At least four different kinds of fishes belonging in three families are employed by the Siamese in matched encounters, but only one of these has ever attained national importance or international celebrity.

Just how early in Siamese history the fighting fish acquired its reputation is not known, but for several hundred years its pugnacious qualities have been recognized and utilized in popular contests.

Up to the year 1850 or thereabouts, the use of the fighting fish in sportive contests in Siam was confined to fishes obtained in open waters; but, in order to insure a regular supply for fighting and betting purposes, domestication and cultivation were then instituted and have since been conducted on an increasingly large scale. It may be noted, however, that in recent years cultivation has been less important as a factor in fighting contests and has represented a better appreciation of the fish's beauty of color and form.

While many kinds of fishes exhibit a belligerent attitude both among themselves and toward other species, it seems probable that in few other fishes is the combative instinct so highly developed as in *Betta splendens.* It is certainly true that in no other fish has the fighting ability been so much improved by cultivation.

The fighting instinct is peculiar to the males and is so strong that a normal fish exhibits it under every condition and at every opportunity. One might reasonably infer that the fighting instinct would develop at the approach of maturity. As a matter of fact, the pugnacious tendency shows itself at an early age; and in captivity fish only 2 months old and less than half-grown should be separated to prevent continual scrapping.

Because of their ever-present eagerness to fight, adult male fish must not only be kept in separate aquaria but the view of rivals in nearby vessels should be cut off by pieces of cardboard; otherwise their vitality and fighting ability will become impaired by incessant futile effort.

The fighting fish has responded well to efforts to produce changes to meet the popular demand. Even in the hands of persons ignorant of the laws of heredity, noteworthy improvements in form, size, coloration, and fighting ability have been brought about; and there is reason to believe that still further improvements may be made.

A person seeing for the first time a wild fighting fish would never suspect the wonderful possibilities in coloration that have been realized under cultivation. The most noteworthy of the color phases that have been established, in addition to intensified reds and blues, are lavenders, iridescent greens, cornflower blue, blue and white, and yellowish and reddish creams with bright red fins. The latter, first produced about 1900, are known to the Siamese as *pla kat khmer* (Cambodian biting fish), probably from having originated among fanciers in French Indo-China.

Along with the development of intensified and new colors, there has come about an increase in the size of the vertical fins, culminating in graceful crapelike effects, which vie with those in the veiltailed and other highly cultivated Japanese goldfish, so that there are now fighting fish whose caudal fins are about as long as the head and body combined.

Fishes caught in open waters and taken indoors will, after a few days, readily respond to an opportunity to fight. The fighting stamina of the wild fishes, however, is not sufficiently developed for present-day requirements in Thailand, and practically all matched combats are now between fishes that have been bred in captivity. Wild fishes may fail to show any pugnacious spirit after a few minutes of active attack, and for an encounter between them to last more than 15 to 20 minutes is unusual.

On the other hand, in fishes reared under careful domestication and intelligent selection of parents, the inherent desire and ability to fight are markedly strengthened. Well-matched fishes may continue their attacks hour after hour without intermission, with only brief excursions to the surface for air. There is a partial respite from active effort while the fishes are in a sparring position, but even then the fins are kept extended, the gill membranes remain expanded, the body muscles are taut, and an alert attitude is constantly maintained. Some of my own fishes have remained pugnacious after 6 hours of uninterrupted combat, but fights do not ordinarily last more than 3 hours. From reputable Siamese informants has come the information that fish have been known to struggle for a whole day and night.

In Siam, as in the various countries into which the fish has been introduced, the usual procedure in arranging a fight is to select two males of approximately the same size and bring them together in separate jars. If they spread their fins, show their colors, and make head-on efforts to reach each other, they are placed together in the same vessel. An ordinary porcelain or tin washbasin makes a good arena, but a rectangular glass receptacle, such as a battery jar, affords a better view. The fish immediately approach each other and indulge in a preliminary display of spread fins, expanding gill membranes, and color waves. A common sparring position finds the fishes side by side with the heads pointing in the same direction and with one fish slightly behind the other. This position may be held for a period varying from a few seconds to several minutes. Then, in quick succession, the fishes attack, their movements being so swift that the human eye can hardly follow the actual impact of the teeth, and the assaults are repeated with short intermissions, during which the same sparring attitude is taken.

The most common points of attack are the anal, caudal, and dorsal fins. The ventral and pectoral fins may be practically untouched at the end of a protracted encounter, but may receive early attention from one or both contestants. The vertical fins, however, are always involved. The first evidence of a spirited encounter is likely to be torn or split fins. As the contest proceeds, there may be extensive loss of fin substance, and with well-matched fishes the vertical fins may utimately be reduced to mere stubs.

The loss or extensive damage of the fins impairs the swimming, steering, and balancing powers and hence places a fish at a disadvantage, but in evenly matched fishes this is not likely to be a final factor in deciding the issue.

Another point of attack is the side of the body. Single scales or clumps of scales may be loosened or detached by a quick nipping act, but in many contests this kind of injury may not occur. Exceptionally the gill covers may be bitten and slight injury may be done to the gills.

An interesting variation in fighting tactics ensues when the fishes come together in a head-on assault and lock jaws. With their jaws firmly locked and their bodies extended, the fishes struggle while partly or completely rotating on their long axis. In my observations, the locked-jaw attack was always comparatively brief and was invariably terminated by the fishes settling to the bottom and remaining perfectly still for, say, 10 to 20 seconds. The hold was then broken and the fishes rapidly sought the surface for air, and then resumed their ordinary tactics. The locked-jaw position interferes with respiration and lasts only as long as the fishes can resist the call of the system for extra oxygen.

During the short interludes in fighting when the demand for oxygen forces the fishes to go to the surface for gulps of air, attacks are always suspended. I have never known one fish to assail another at such a time. It is literally a breathing spell provided for in the fighting fish's code of ethics.

Fighting contests are decided by the general exhaustion and the failure of stamina in the combatants rather than by a definite injury or a knock-out assault. Sooner or later one fish shows a lack of ability or desire to continue the fight and swims away—literally turns tail—when his rival assumes a position for attack. The engagement is then over, the fishes separated, the wagers, if any, are paid, and the owners put their charges into jars and go their respective ways.

At the end of a protracted contest both fishes may present a most unattractive appearance because of their mutilated fins, but they seem to experience no discomfort and, if permitted, would fight again the next day. The fins regenerate rapidly and completely, and at the end of a few weeks may show no signs of injury. Loss of scales may be more serious, inducing the development of fungus.

My experience, which extended over 12 years and covered many hundreds of exhibitions, coincides with that of most observers in finding nothing brutal, cruel, or repulsive in fighting-fish contests. The participants seem to get so much satisfaction from their encounters, their physical discomfort is apparently so negligible, and their recovery is so complete that there is little occasion to expend sympathy over them, while their graceful movements, muscular agility, acumen, tenacity, and wonderful color displays cannot fail to arouse enthusiasm even in the most sensitive spectators.

Wholly erroneous impressions on this subject have been conveyed in some published articles. In an account that has often been quoted, one of the unfortunate combatants always terminates his fighting career and his very existence by literally bursting because of his futile efforts to reach his adversary kept in a separate jar. Another description of the fish and their fights concludes with a statement which, if true, would enlist our sympathy:

"The two [fishes] are brought together in the same bowl and they forthwith begin to tear at each other with their mouths and sharp spines, until the one is overpowered. The victor seldom lives to enjoy his triumph."

As has been pointed out, fighting is done wholly with the teeth, and one fish is not overpowered. I never knew the victor, or even the vanquished, to succumb to a fight or to undergo serious injury.

An outstanding peculiarity of the fish is its dependence on atmospheric air. In an open water course, just as in a well-aerated aquarium, the fish cannot obtain through its gills dissolved oxygen in amount sufficient for its needs, and hence it has to make frequent excursions to the surface to take in mouthfuls of air which it utilizes by its accessory respiratory apparatus. The fish does not loiter at the surface where, in a wild state, it is exposed to attack by birds and other fish-eating animals. It projects its mouth for only an instant, expelling a bubble of vitiated air and taking in a new supply, and then rapidly retreats toward the bottom.

The air-breathing apparatus is of simpler construction than in some related species, the "climbing perch" for example, which can and do spend considerable time out of water. Above the gills there is in each side of the head a cavity lined with vascular epithelium, the absorptive surface being increased by several projecting laminae.

The bubble-blowing habit is strongly developed in the male fish. At the time the bubbles are made there is a viscid mucous secretion of the mouth or pharynx, which strengthens and makes more lasting the walls of the bubbles and tends to keep the bubbles in a compact mass.

The purpose of the bubbles—to serve as a nest for the eggs and a hover for the newly hatched young—is admirably achieved. As the bubbles gradually lose their stickiness and become scattered or ruptured, one may observe the male constantly engaged in renewing the supply.

If one day a mature female fish is introduced into a vessel with a male fish that has been blowing bubbles, the probability is that next morning the bubble mass will be found to contain several hundred minute transparent eggs not easily distinguished from bubbles without a magnifying glass.

At egg-laying time the fishes consort near the surface, and at short intervals the eggs are extruded in small batches. As the eggs slowly sink toward the bottom, both the male and the female fishes go after them, gently take them in their mouths, and returning quickly to the surface blow the eggs into the bubble nest, repeating the performance as often as may be necessary to gather up all the eggs. This continues for several hours until all the ripe eggs have been voided.

The role of the mother fish is almost entirely restricted to the production of eggs. After the eggs are once placed in the nest, her family duties cease, and all subsequent care of eggs and young devolves wholly on the male.

The fish is rather prolific. At one spawning period from 200 to 700 eggs may be expelled, the average number for a fully developed normal fish being 400 to 500. A month after one batch of eggs has been produced, a given female may be ready to yield another lot, so that in the course of a year one fish may be responsible for 2,500 to 5,000 or more eggs.

Aided partly by capillary attraction, partly by the viscidity of the bubbles, the eggs are held in the nest until hatching ensues. The incubation period is remarkably short, covering only 30 to 40 hours in water at 80° to 85° F. Should any of the eggs drop from the nest and fall to the bottom, the male recovers them and blows them back.

The newly hatched fishes find shelter under the bubble nest, and remain there while their yolk sacs are being absorbed and their fins are developing. If they stray from their proper place before they are old enough, the male carries them back to the nest and gently ejects them; and during the entire period of infantile helplessness the male repeatedly takes the young in his mouth and blows them out with new bubbles, thus insuring proper oxygenation.

Throughout the nesting period the male fish is extremely busy and his vigilance never relaxes. In addition to making and maintaining the bubble nest, replacing eggs that may drop from the nest, rounding up the straggling young, and mouthing the young at intervals, he is constantly on the alert to protect the eggs and young from intruders that may devour them. The chief offender is the mother fish. In a wild state, she can be forcefully driven off and kept at a distance, but in the restricted quarters of an aquarium she must be removed as soon as egg laying is completed.

The presence of the male seems to be essential in the development and hatching of the eggs. If the male is removed from the aquarium, the eggs, or most of them, will fail to hatch. Those that fall to the bottom will suffocate; while the vitality of those that remain in the nest may be impaired by the lack of the aeration that comes from mouthing and bubble blowing.

It is of interest to note that the forbearance of the male from eating the eggs and young is not due to any temporary impediment to his digestive powers, such as a physiological closure of the esophagus. He can and does eat mosquito larvae throughout his period of guard duty.

With all the solicitude shown by a male for his progeny, it may be noted that he cannot distinguish his own young from those of another parent introduced into his aquarium. Foster offspring receive the same care as his own.

Another aspect of the interesting behavior of *Betta* is shown when a male parent is taken away from his nest and returned after a few days; he promptly devours his young.

The fighting fish is a confirmed carnivore. This would be indicated by its dental equipment and short intestine even if not shown by direct observation on wild and domesticated fish.

In a wild state, the fish renders a useful service to mankind and to land animals generally by its destruction of mosquito larvae. The fish inhabits the same kinds of weedy waters in which the eggs of various mosquitoes are laid and hatched, and mosquito larvae are the favorite, often the exclusive, food throughout the year. As the fish's appetite is keen, its digestion rapid, and its feeding activities more or less continuous during daylight, the daily consumption of potential bloodsucking pests is large. Based on the observed requirements and the actual consumption of mosquito larvae by fighting fish in small aquaria, I would not hesitate to estimate an annual intake of 10,000 to 15,000 larvae per adult wild fish under normal conditions.

When the young fishes first begin to feed their mouths are too small to admit mosquito larvae, and during a period of 10 to 12 days following the absorption of the yolk sac they subsist chiefly on minute crustaceans, which swarm in the local waters.

The preference is for living, moving food. Given the choice of both active and dead larvae, the fishes may entirely reject the latter until driven by extreme hunger. Under the stress of necessity they will take selected nonliving food and thrive on it. A lot of fishes that I took from Bangkok to San Francisco were, after the first few days of the voyage, fed successfully on minute scrapings of raw fish provided by the ships' stewards.

In Siam, mosquito larvae are regarded as essential for the proper nourishment of fish under domestication. For supplying the daily needs of my fighting fish in Bangkok, two coolies spent much of their time in locating breeding places of mosquitoes, collecting the larvae with fine-mesh nets, separating the larvae from plant and animal debris, and feeding the clean larvae to the fish at regular times and in quantities based on the reactions of the fish. The wrigglers, held in a coffee cup or rice bowl, were administered with a spoon.

In the capital of Siam where there are some thousands of amateur fighting-fish fanciers and many professional breeders and dealers, there is a large and steady demand for mosquito larvae. To meet this demand, which becomes acute during the dry season, there has sprung up the strange business of breeding mosquitoes and selling their larvae to owners of fightingfish; and a number of people thus gain a livelihood.

The Thai name is *pla kat* (biting fish).

Genus TRICHOGASTER Bloch

Trichogaster Bloch, *in* Schneider, Systema ichthyologiae, p. 164, 1801. (Type, *Labrus trichopterus* Pallas.)

As pointed out by Myers (1923, p. 111) the fishes usually called *Trichopodus* (Lacepède, 1802) should bear the name *Trichogaster*, first used by Bloch (1801), *Trichopodus* being a synonym. The type species of *Trichogaster* (and of *Trichopodus*), namely *trichopterus*, was first indicated by Cuvier and Valenciennes in 1831. The Indian fishes formerly called *Trichogaster* should properly bear the name *Colisa* of Cuvier and Valenciennes (1831), with *fasciata* Bloch (1801) as the type.

These fishes are a rather conspicuous feature of the fresh-water fauna of Thailand, one or several species being taken in almost every haul of seines or traps in suitable localities. They blow masses of glutinous bubbles in which their eggs are deposited, and they are partly dependent on atmospheric air for the oxygenation of their blood, the gills being supplemented by a special air-breathing apparatus.

All the known species, four in number, are found in Thailand. They are:

1*a*. Dorsal fin with 3 or 4 spines; scales in longitudinal series above lateral line 58 to 65; coloration plain ---------- microlepis
1*b*. Dorsal fin with 5 to 9 spines.
  2*a*. Anal rays XII–XIV, 25–30; body with no dark oblique cross bands, but with a reddish brown network on a pale green background, a dark stripe from eye to base of caudal fin; diameter of eye much more than 0.5 postorbital part of head ---------- leerii
  2*b*. Anal rays IX–XII, 33–38; body with numerous dark oblique cross bands; diameter of eye 0.5 postorbital part of head or less.
    3*a*. Dorsal soft rays 8 or 9; scales in longitudinal series above lateral line 40 to 52; a large round black spot on middle of side and another on caudal peduncle near base of caudal fin ---------- trichopterus
    3*b*. Dorsal soft rays 10 or 11; scales in longitudinal series above lateral line 55 to 63; no round black spot on middle of side or on caudal peduncle ---------- pectoralis

TRICHOGASTER MICROLEPIS (Günther)

Osphromenus microlepis GÜNTHER, 1861, vol. 3, p. 385 (Cambodia); 1864, p. 176 (Siam and Cambodia).—PETERS, 1868, p. 260 (Siam).
Trichopus microlepis SAUVAGE, 1881, p. 166 (Siam).
Trichopus parvipinnis SAUVAGE, 1883b, p. 151 (Menam Chao Phya).
Trichopodus microlepis REGAN, 1910, p. 784 (Bangkok, Menam Chao Phya).—FOWLER, 1935a, p. 137, fig. 111 (Bangkok); 1937, p. 222, fig. 214 (Bangkok, Tachin, Mepoon).
Deschauenseeia chryseus FOWLER, 1934a, p. 147, fig. 117 (Bangkok).

Described from Cambodia when it was a part of Thailand, this fish in recent years has been found to have a rather wide distribution in Central Thailand. Most of the records are for Menam Chao Phya and tributaries, but Fowler records one specimen from the Tachin.

A length of 15 cm. is attained. The species is easily recognizable by its plain coloration, small scales, and reduced number of dorsal spines.

The generally used vernacular name *pla kadi* is shared with other members of the genus. Under the notion that the fish is the female of *T. trichopterus*, it is sometimes called *pla kadi nang* (*nang*, woman or female).

TRICHOGASTER LEERII (Bleeker)

Trichopus leerii BLEEKER, 1852 (67), p. 577 (Palembang, Sumatra).
Osphromenus leerii BLEEKER, 1865 (356), p. 173 (Siam).
Trichopodus leeri WEBER and DE BEAUFORT, 1922, vol. 4, p. 367 (Siam).—HORA, 1923b, p. 182 (Bangkok).
Trichopodus leeri FOWLER, 1939, p. 41 (Huey Yang).

From Sumatra and Borneo, the range of this species extends to Malaya and Thailand. It is not rare in the Bangkok region.

A length of 10 to 12 cm. is attained.

The body and vertical fins are pale green with a reddish brown network; a dark stripe extends from the snout, through the eye, to the base of the caudal fin, where it ends in a spot; and in the male at egg-laying time the breast becomes bright red. An excellent and attractive aquarium fish.

The vernacular name is *pla kadi nang* (*nang*, female).

TRICHOGASTER TRICHOPTERUS (Pallas)

FIGURE 98

Labrus trichopterus PALLAS, 1770, pt. 8, p. 45 (no locality given).
Trichopus trichopterus BLEEKER, 1859–60 (239), p. 101 (Siam).—SAUVAGE, 1881, p. 160 (Siam); 1883b, p. 151 (Menam Chao Phya).—FOWLER, 1935a, p. 137 (Bangkok).
Osphromenus siamensis GÜNTHER, 1861, vol. 3, p. 385 (fresh waters of Siam); 1864, p. 175 (Siam and Cambodia).—BLEEKER, 1865 (347), p. 34 (Siam); 1865 (356), p. 173 (Siam).—VON MARTENS, 1876, p. 395 (Bangkok).—KÁROLI, 1882, p. 172 (Siam).
Osphromenus trichopterus BLEEKER, 1865 (356), p. 173 (Siam).—PETERS, 1868, p. 260 (Siam).
Trichopus siamensis SAUVAGE, 1881, p. 166 (Bangkok); 1883b, p. 151 (Menam Chao Phya).
Trichopodus trichopterus WEBER and DE BEAUFORT, 1922, vol. 4, p. 366 (Siam).—HORA, 1923b, p. 182 (Bangkok); 1924a, p. 483 (inner and outer lakes, Tale Sap).—FOWLER, 1934a, p. 149 (Bangkok, Chiengmai, Metang River); 1934b, p. 350 (Bangkok, Krat); 1937, p. 222 (Bangkok, Mepoon, Pitsanulok, Rayong); 1939, p. 41 (Huey Yang).
Trichopodus maculatus VIPULYA, 1923, p. 225 (Bangkok).

This species, of the Indo-Australian Archipelago, Malay Peninsula, and French Indo-China, is the most abundant and most widely distributed member of the genus in Thailand. It has been collected in Peninsular, Central, Southeastern, and Northern districts, and in the last-named region it is known from the basins of the Salwin, Menam Chao Phya, and Mekong.

A length of 12 cm. is attained, but full maturity is reached at about 8 cm.

The fish is found in streams, canals, ditches, lakes, ponds, and swamps, and is partial to a weedy environment, which affords protection from predatory fishes and birds and provides a suitable location for its bubble-nest.

This is the most beautiful of the local species. It makes an attractive aquarium fish.

The variation in the number of dorsal and anal rays is considerable, as noted by Weber and de Beaufort. In specimens from the Meyuam a tributary of the Salwin, at Mesarieng, Northern Thailand, the fin formulae in a limited number of examples examined were dorsal VII, 8, VIII, 9, and IV, 8, and anal XI, 35 and XII, 34, while in specimens from the Mekang, a tributary of the Meping, Northern Thailand, the dorsal rays were uniformly VIII, 7 and the anal rays XI, 34 and XII, 32.

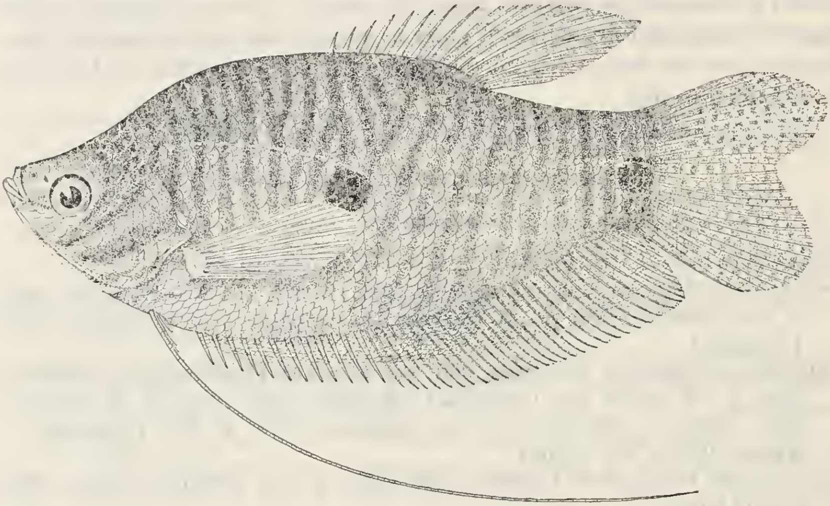


FIGURE 98.—*Trichogaster trichopterus* (Pallas). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Over most of Thailand the vernacular name is *pla kadi*, often expanded to *pla kadi mor* (*mor*, a cooking pot) to distinguish from other species. Along the Mekang, tributary of the Meping at the base of Doi Angka in Northern Thailand, the fish is called *pla salark*, and the same name is used on the Meyuam at Mesarieng. Another local northern name is *pla salaring*.

TRICHOGASTER PECTORALIS (Regan)

Trichopodus pectoralis REGAN, 1910, p. 784, pl. 79, fig. 1 (Siam).—FOWLER, 1934a, p. 149 (Bangkok); 1934b, p. 350 (Bangkok); 1937, p. 222 (Bangkok, Pitsanulok, Mepoon, Kemarat).—INDRAMBARYA, 1939, p. 127, pl. 1 (Bung Borapet).
Trichogaster pectoralis SMITH, 1933b, p. 259 (Siam, Malaya).

This is the largest and most important of the local trichogastrids. The species, singularly enough, was without a name until 1910 when Regan, having before him specimens from Thailand and Singapore, described it as *Trichopodus pectoralis*, in allusion to the large pectoral fin which in adults is longer than the head.

The fish is at home in ponds, lakes, and sluggish waters generally, and has a wide distribution over the Central area. It is naturally absent from Peninsular, Northern, and Western Thailand. The range extends to Cambodia and probably to other provinces of Indo-China.

A length in excess of 20 cm. is attained. On account of its size and food qualities, the fish is very popular all over the country, and in sections where it does not live there is an extensive trade in a product preserved by air-drying.

This fish is well adapted for ponds, and its cultivation in Thailand after the manner of the fresh-water basses in the United States will no doubt be taken up in time. In the Malay States where it was introduced from Thailand it is now widely distributed, abundant, and an important food article. (See Smith, 1933b.)

In the Supanburi district of Central Thailand, in Klong Kok Kamyan, there is, or has been, a local race of *pla salid* which is very much larger than fish elsewhere. It has been reported to be as broad as a man's hand is long, and its local reputation as a food fish has been very high. Owing to active demand and lack of protection, supplemented by possible curtailment of spawning facilities, the fish had become very scarce by 1925 and no examples were obtainable on a special visit made by the writer in that year.

In the mature male the dorsal fin when flexed reaches to or beyond the base of the caudal fin, while in the female the dorsal fin falls far short of the caudal base, as pointed out in a paper (1930) by Boon Chuay Indrambarya of the Thailand Department of Agriculture and Fisheries. This is a point of practical value in pond-cultural operations.

An excellent colored plate was published by Chevey (1932b), but unfortunately the title reads *Trichopodus trichopterus*, and in the text (pp. 65–67) the two species appear to be confused, for the Thai names *pla salid* and *pla kadi* are attributed to *trichopterus*. In Thailand the name *pla salid* is always given to *pectoralis* and to no other species. The Thai also recognize this fish by the name *pla bai mai.*

Family OPHICEPHALIDAE: Serpent-head Fishes

Genus OPHICEPHALUS Bloch

Ophicephalus Bloch, Naturgeschichte der ausländischen Fische, vol. 10, p. 117, 1797. (Type, *Ophicephalus punctatus* Bloch.)

The serpent-head fishes, representing many species, are a very conspicuous element of the fish life in almost every part of Thailand, in lowland streams and canals, in upland and mountain streams, and in lakes, ponds, and swamps. The various species exhibit a wide range in size, from about 10 cm. in *O. gachua* to over a meter in *O. micropeltes.* All the species are eaten by the Thai people, and one of them

(*O. striatus*) may be considered the commonest of the staple food fishes of the country. The various species are very hardy and, if kept moist, can remain alive for a long time out of water, owing to the possession of a suprabranchial cavity. This cavity, communicating with the pharynx, is not nearly so complicated as in *Anabas* and other members of the Anabantidae; it has no labyrinthine organ but is lined with a thin epithelium. The assertion by Günther (1861, vol. 3) that the purpose of this cavity is to retain water is open to question. The obvious function of the cavity in the ophicephalids (in which it is of simplest form) as in other fishes of the order Labyrinthici is to permit aerial respiration.

Under the strict rules of zoological nomenclature, the proper generic name for these fishes is *Channa.* The present writer feels, however, that the time-honored name of *Ophicephalus* should, if possible, be retained and that the International Commission on Zoological Nomenclature might very properly bring in a special rule to cover the case.

The eight species of *Ophicephalus* from Thailand may be differentiated as follows:

1*a*. Vomer and palatines with a more or less continuous pluriserial band of small teeth, none of them canine.
  2*a*. A conspicuous black light-edged ocellus at upper base of caudal fin.
    3*a*. A posterior row of about 12 large conical teeth on each ramus of lower jaw; lateral line scales 60 to 70, dropping 2 rows at 16th to 18th perforated scale; scales in transverse series 4.5–1–11 to 13; rows of scales between eye and angle of preopercle 10; dorsal rays 45 to 55; anal rays 28 to 36; 4 or 5 dark blotches along side below lateral line__ marulius
    3*b*. Posterior teeth in lower jaw uniserial, small, interspersed with widely separated blunt caniniform teeth; lateral line scales 55 to 58, dropping abruptly 2 rows at 17th to 20th perforated scale; scales in transverse series 35–1–10; rows of scales between eye and angle of preopercle 5; dorsal rays 45 to 47; anal rays 30 or 31; no dark blotches on side____ marulioides
  2*b*. No ocellus at base of caudal fin; a posterior row of about 5 canine teeth on each ramus of lower jaw; lateral line scales 52 to 57, dropping abruptly 2 rows at 17th to 20th perforated scale; scales in transverse line 4 to 5.5–1–8 to 10; dorsal rays 37 to 45; anal rays 21 to 27; back dark green, dark brown, or black; side usually with dark stripes running obliquely upward above, obliquely downward below; underparts white, irregularly blotched with black or brown___________________ striatus
1*b*. Vomer and palatines with 1 or 2 series of teeth which are mostly canine or caniniform.
  4*a*. Lateral line scales 41 to 45, dropping 1 row at 10th to 13th perforated scale; scales in transverse series 3 or 4.5–1–7; rows of scales between eye and angle of preopercle 4 or 5; rows of scales on opercle 3; dorsal, caudal, and anal fins with a narrow bright red margin (turning white in alcohol)____ gachua

4*b*. Lateral line scales 50 to 65.

5*a*. Lateral line scales 50 to 55, dropping 3 rows at 14th to 16th perforated scale; scales in transverse series 4 or 4.5–1–8 or 9; rows of scales between eye and angle of preopercle 6 or 7; dark green or dark blue above, yellowish brown or reddish brown below; a red band from snout to caudal fin in young ---------------------------- melasomus

5*b*. Lateral line scales 58 to 65; scales in transverse series 5 or 5.5–1–10 or 11; rows of scales between eye and angle or preopercle 10 to 13.

6*a*. Lateral line dropping 2 rows at 18th to 20th perforated scale; interorbital space less than length of snout; brown above, yellow below, a double row of dark spots on side with a zigzag light stripe between the spots -- lucius

6*b*. Lateral line dropping 1 row at 15th to 20th perforated scale; interorbital space greater than length of snout; olive green, with a light stripe from eye to caudal fin, and a series of dark blotches above light stripe and another below; three oblique brown bands on side of head -- siamensis

4*c*. Lateral line scales 82 to 95 [110 (Day)] without an abrupt drop; scales in transverse series 5.5 or 6.5–1–15 or 16; rows of scales between eye and angle of preopercle 15 to 17; rows of scales on opercle 8; dark brown or dark blue above, white below; 2 narrow parallel black stripes extending from eye and angle of mouth to tip of caudal fin, interspace red (the stripes breaking up into irregular spots and blotches in older examples) -- micropeltes

OPHICEPHALUS MARULIUS Hamilton

Ophiocephalus marulius HAMILTON, 1822, pp. 65, 367, pl. 17, fig. 19 (India).—KÁROLI, 1882, p. 171 (Siam).

Ophicephalus marulius SMITH, 1934b, p. 324 (Bangkok, Kanburi, Pakjong).

The range of this species extends from India to China. It is one of the rarest of the serpent-heads found in Thailand, and is definitely known from only two specimens. One, 27 cm., long was obtained in Tonburi, Bangkok; the other, 40 cm. long, said to have come from Kanburi, on the Meklong, in west-central Thailand, was exhibited alive at a fair in Bangkok in December 1933. Károli's record for "Siam" may be accepted as authentic. The present writer's reference (1934b) to numerous small specimens taken in May 1925 in headwaters of the Menam Mun in Eastern Siam was incorrect: the species involved was *O. melasoma*, q. v. A length of 4 feet is said to be attained in India.

Hamilton (1822) noted of this fish that "in the lower parts of Bengal, the persons dedicated to religion, from some old prejudice, think it unlucky to say that it is either good or bad." Day (1878) quotes Mason as stating: "Some of the Karens in Burma regard these fishes with superstitious awe, and abstain from eating them. They have a legend that they were formerly men, changed into fish for their sins, and the Karens of Tavoy say, 'if people eat them, they will be transformed into lions.' "

In the Bangkok region this fish has received the name of *pla chon ngu hao* (*ngu hao*, cobra) and its bite is reputed to be very poisonous, a belief without foundation in fact.

OPHICEPHALUS MARULIOIDES Bleeker

Ophicephalus marulioides Bleeker, 1851 (49), p. 424 (Sambas, Borneo).—Herre and Myers, 1937, p. 71 (Tale Sap).

The only Thailand record for this species is that of Herre and Myers, who list a specimen 14 cm. long obtained at Singora, the Peninsula. Dr. Herre writes that the specimen was obtained in the Singora market and undoubtedly came from the inner lake of the Tale Sap. The range of the fish otherwise covers Sumatra, Borneo, and several nearby small islands of the East Indies.

OPHICEPHALUS STRIATUS Bloch

Ophicephalus striatus Bloch, 1797, vol. 10, p. 117, pl. 359 (Malabar).—Fowler, 1934a, p. 149 (Chiengmai, Metang, Chantabun).

Ophiocephalus striatus Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).—Sauvage, 1881, p. 160 (Siam).—Károli, 1882, p. 171 (Siam).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Weber and de Beaufort, 1922, vol. 4, p. 317 (Siam).—Hora, 1923b, p. 180 (Bangkok, Koh Chang).—Vipulya, 1923, p. 224 (Bangkok).

Ophiocephalus vagus Sauvage, 1881, p. 160 (Bangkok).

Channa striata Fowler, 1937, p. 222 (Bangkok, Pitsanulok, Tachin, Kemarat).

This, the most widely distributed and economically the most important member of the genus, ranges from China to India and Ceylon, and through East Indies and Philippines, in rivers, canals, lakes, ponds, swamps, and marshes. In Thailand the fish is found throughout the length and breadth of the coastal plains, central plains, eastern plateau, and piedmont districts, but is replaced by minor species in the mountainous regions. It is known throughout Thailand as *pla chon* or *pla chorn*.

A length of fully a meter is attained by this fish, but so large a size is rarely observed in recent years. Examples up to 60 to 75 cm. are fairly common, but the largest demand in the retail fresh-fish markets is of a fish under 30 or 40 cm. long.

The interesting nesting habits of this species, together with the development of the eggs and young, have been best described by Dr. A. Willey (1909), whose observations, while made in Ceylon, are entirely in conformity with the less comprehensive ones in Thailand. The nest is prepared by the parent fish's biting off the aquatic vegetation over a roundish area in shallow water near the edge of a lake or canal; and when the eggs are laid they form a thin film at the surface and are assiduously guarded by the male parent.

The eggs, 1.25 to 1.5 mm. in diameter, owe their buoyancy to the presence of a large oil globule. They float flush with the surface, have a rich yellow or amber color, and are usually mixed with small leaves and bits of vegetable matter such as is ordinarily found in quiet, shallow, weedy waters.

Incubation is rapid and is completed within 3 days, varying within narrow limits with the temperature of the water and the amount of direct sunlight. On the day of hatching the larva is 3.5 mm. long. In 4 days, at a length of 6.75 mm., the larva leaves the surface and swims freely at different levels, and respiratory movements have begun, although with the cessation of active effort the larva rises to the surface and cannot remain at the bottom. By the end of the fifth week, having reached a length of 10 to 12 mm., the larva can live comfortably at or near the bottom of a small aquarium, and go to the surface at short intervals to take in air. With the coming of the ninth week, having attained a length of 17 to 20 mm., the young goes to the bottom, hides in the mud, and thenceforward assumes the habits of the adult.

A fish about 6 cm. long, carried from Bung Borapet to Bangkok early in 1932, was kept in an aquarium with other fish of the same lot and on September 20, having attained a length of 21 cm., spawned. The eggs were removed to a separate tank and hatched September 22, the young shortly after hatching being 4 mm. long, with a brown yolk sac 1.8 mm. long. When at rest the young remained at the surface of the water with the yolk sac uppermost, the long axis of the body being parallel with the surface; they were able to maintain themselves on the bottom or below the surface only by active swimming effort. On September 23 some of them began to swim with the back uppermost, and by September 25, having reached a length of 7 mm., most of them had assumed the upright position.

The fish is carnivorous and subsists on a variety of living creatures, including fish, frogs, snakes, and insects. While ordinarily it is readily taken by hook and line, the male fish cannot be caught during the period when it is protecting its eggs and young. A very simple trap designed especially for use at that time consists of a wide-mesh bamboo cone kept in place by a small stake or wooden pin stuck into the bottom. Although one of the astute fresh-water fishes, *Ophicephalus striatus* tries to pass through the trap and is unable to disengage itself.

The fish has the regular habit of settling in the bottom mud of lakes, swamps, and canals as the waters dry up and of going deeper and deeper into the mud as desiccation proceeds. As long as the skin and breathing apparatus keep moist, the fish can survive without water for a number of months, occupying pockets in the stiff mud sometimes nearly a meter below the surface and subsisting on the stored fat until the rains set in.

Enormous numbers of *pla chon*, running into millions of individuals each year, are consumed by the Thai. In addition to use in a fresh condition, large numbers are preserved by being sun-dried; the fish are decapitated, split, deeply gashed in regular lines, and cured in a flat shape, which facilitates packing and transportation.

The high reputation as a food fish that the *pla chon* has among the Thai is deserved. The flesh is firm, white, practically boneless, and of a most agreeable flavor. The writer found the flavor suggestive of that of the American black bass.

One of the daily sights in Bangkok and other communities with fish markets is that of someone walking home with a live *pla chon* dangling head upward from a short length of bamboo fiber, secured around the fish just back of the pectoral fins.

A curious fishery is carried on about the Tale Noi and in other swampy areas in which the *pla chon* abounds. With the progress of the dry season and the evaporation of the water, the fish go deep into the mud and are there sought by the fishermen, who wade into the stiff mud to their waist or above and reach the fish by using a long knife to cut away the mud in layers, the fish being found singly or in clusters in cavities in the mud. This is a laborious occupation, but it is justified by the high esteem in which the *pla chon* is held as a food fish.

OPHICEPHALUS GACHUA Hamilton

Ophiocephalus gachua Hamilton, 1822, pp. 68, 367, pl. 21, fig. 21 (Bengal).—Károli, 1882, p. 171 (Siam).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Weber and de Beaufort, 1922, vol. 4, p. 321 (Siam).—Hora, 1923b, p. 181 (Bangkok, Koh Chang).

Ophicephalus gachua Fowler, 1934a, p. 149 (Chiengmai, Doi Sutep, Chiengdao, Metang, Chantabun, Bua Yai); 1934b, p. 350 (Ban Thung Luang).

Channa gachua Fowler, 1939, p. 75 (Trang).

The distribution of this species is wide. From Java, Borneo, Sumatra, and other East Indian islands, the fish ranges to Indo-China, Malaya, Thailand, the Andaman Islands, Ceylon, Burma, India, Baluchistan, and Afghanistan.

In Thailand this fish, while found in lowland waters as at Bangkok and in lakes, is characteristic of mountain streams. Specimens from such streams have been examined from Ronpibun, Peninsular Siam; Koh Chang, in the Gulf of Siam off Southeastern Thailand; and from various brooks in the Northern area tributary to the Meping, the Mekong, and the Salwin. In the Khun Tan Mountains the fish has been found in Huey Luk at an elevation of 2,000 feet, while on Doi Hua Mot, in Huey Melao, it has been collected at 3,300 feet. Specimens from a pool in a hill stream on Koh Yao Yai, an island off the west coast of Thailand, were obtained by Dr. A. F. G. Kerr. The collections made for the U. S. National Museum by H. G. Diegnan contain numerous specimens from the Northern region; Nong Pratip, off the Meping at

Chiengmai; Huey Kao, a branch of the Meping; Melong, a tributary of the Mechem; Meklang, on Doi Angka; and Huey Mekong Kha, a tributory of the Salwin at the foot of Doi Mekong Kha; also Huey Nam Puat, a tributary of the Mekong in French Laos, just over the border of Nan Province.

O. gachua is one of the smallest members of the genus, rarely exceeding 20 cm., and in the restricted habitat of small mountain brooks it reaches maturity when 10 cm. long.

It displays the hardiness of its relatives and is an attractive little creature. Although of dull coloration, the dorsal, caudal, anal, and pectoral fins have a narrow, sharply defined blood-red margin (which becomes white in alcoholic specimens and is referred to as white in some of the published descriptions), and the pectorals are prettily marked in many of the full-grown examples with a black spot at the base and 5 or 6 narrow, distinct, black cross bands (referred to by Day but not by Weber and de Beaufort).

The lateral line varies within narrow limits. It usually stops at the eleventh to thirteenth perforated scale and resumes on the next scale of the next row. Variations met with in a lot of specimens from a tributary of the Meping in Northern Thailand were: (1) Lateral line stopping at tenth scale on each side and resuming on the next scale of the next row; (2) lateral line stopping at tenth scale on one side and resuming at thirteenth scale of row below, and stopping at thirteenth scale on other side and resuming at fourteenth scale of row below; (3) lateral line stopping at eleventh scale of one side and twelfth scale of other side; (4) lateral line stopping at eleventh scale of one side and resuming at thirteenth scale of next row, and stopping at thirteenth scale of other side and resuming at fourteenth scale of next row; (5) lateral line stopping on thirteenth scale of one side and fourteenth of other side, and resuming on next scale of row below.

This fish is known in all parts of Thailand as *pla kang*.

OPHICEPHALUS MELASOMUS Bleeker

Ophicephalus melasoma Bleeker, 1851 (49), p. 424 (Sambas, Borneo).

Ophiocephalus melanosoma Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).—Sauvage, 1881, p. 160 (Siam).—Weber and de Beaufort, 1922, vol. 4, p. 319 (Siam).

Channa melasoma Fowler, 1937, p. 224, fig. 215 (Mepoon, Kemarat).

The range of this species extends from Indo-China through Thailand to Sumatra, Borneo, and Palawan. Definite localities for Thailand are those given by Fowler (1937) and headwaters of the Menam Mun at Pakjong in the Eastern district. From the last-named place numerous small specimens, taken May 12, 1925, exhibit the characteristic coloration: Generally dark green or dark blue, with a bright red band from snout to caudal fin.

A maximum length of 30 cm. is attained.

The figure ascribed to this species by Fowler from a specimen about 7 cm. long from Mepoon differs in some essential features from the descriptions of Bleeker and of Weber and de Beaufort. Thus, these latter authors represent the lateral line as dropping abruptly for three scales at the fourteenth or fifteenth perforated scale, whereas in Fowler's figure the lateral line drops abruptly for one scale after the tenth perforated scale—a difference that seems too great to fall within the limits of individual variation. Another difference is in the lateral line scales, given as 50 to 52 by Weber and de Beaufort and as 54 or 55 by Günther but represented as 44 in Fowler's figure.

This fish is rare in Thailand and seems to be unknown to the fishermen, having received no distinctive name that has been recorded.

OPHICEPHALUS LUCIUS Cuvier and Valenciennes

Ophicephalus lucius CUVIER and VALENCIENNES, 1831, vol. 7, p. 416 (Java).—FOWLER, 1934a, p. 149 (Bangkok); 1934b, p. 350 (Southeastern Siam).

Ophiocephalus lucius BLEEKER, 1865 (356), p. 174 (Siam).—WEBER and DE BEAUFORT, 1922, vol. 4, p. 326 (Siam).—HORA, 1923b, p. 181 (Bangkok).

Channa lucius FOWLER, 1935a, p. 138 (Bangkok); 1937, p. 224 (Bangkok, Pitsanulok, Mepoon).

Besides inhabiting Thailand, this species occurs in Java, Sumatra, Borneo, and other islands of the Indo-Australian Archipelago, Malaya, Indo-China, and China. The range covers most of Central Thailand, and extends to the Southeastern district (Chantabun River) and to the Peninsula (upper tributaries of the Tapi River and Patani Province). No specimens are known from Northern, Eastern, and Western Thailand. Most of the local records are for streams, but the fish inhabits also lakes and ponds.

The maximum length of the fish is 35 to 40 cm. Of the various adult examples preserved or examined in Thailand, the usual length has been from 22 to 25 cm. The head has a more snaky appearance than in most of the other local species.

The Thai vernacular name for the fish is *pla kasong*, applied to no other fish. Malays in some parts of Patani Province call the fish *ikan bujok*.

OPHICEPHALUS SIAMENSIS Günther

Ophiocephalus siamensis GÜNTHER, 1861, vol. 3, p. 476 (Siam); 1864, p. 178 (Siam and Cambodia).—BLEEKER, 1865 (356), p. 174 (Siam).—SAUVAGE, 1881, p. 160 (Siam).—KÁROLI, 1882, p. 171 (Siam).—SAUVAGE, 1883b, p. 151 (Menam Chao Phya).

This species was based on a single specimen collected in Thailand by Mouhot, and is the only ophicephalid peculiar to this country.

Following Günther's description in 1861, the species was cited by Bleeker in 1865 and recorded by Károli in 1882 and by Sauvage in 1883. Since Sauvage's citation of a specimen from the Menam Chao Phya, the species has not been detected in the extensive collections made in all parts of Thailand. The explanation may lie in the rarity of the species or in the failure of collectors to recognize it or to distinguish it from other species. Günther made no comparison with related forms, and his description falls far short of present-day requirements. The type, 44 lines (7.4 inches) long, is in the British Museum, and the original description is as follows:

> D 42. A 27. L. Lat. 65. L. transv. 5/11.
>
> Large teeth in the lower jaw, on the vomer and the palatine bones. The height of the body is contained six times and four-fifths in the total length, the length of the head three times and two-fifths, the length of the caudal six times. The width of the interorbital space is more than the extent of the snout, and two-ninths of the length of the head. Cleft of the mouth wide, the maxillary not extending to the vertical from the posterior margin of the eye (in old specimens it probably reaches to below that margin). There are eleven series of scales between the eye and the angle of the praeoperculum; scales on the upper surface of the head of moderate size. The pectoral extends to the origin of the anal fin, and its length is less than one-half of that of the head; the ventral is not much shorter than the pectoral. Greenish-olive, with darker streaks along the series of scales; a light longitudinal band from the eye to the middle of the caudal fin; two series of alternate darker blotches, one above the light band, the other below; side of the head with three oblique brown bands; dorsal and anal fins with oblique blackish stripes; caudal with blackish spots; the lower side of the head blackish, with white spots.

Dr. Ethelwynn Trewavas, of the department of fishes of the British Museum, has by request examined the type and has kindly indicated the peculiarities of the lateral line, as follows:

> In the type of *Ophicephalus siamensis* the lateral line runs nearly straight to the 14th (left) or 16th (right) perforated scale. The drop to the lower row involves the 15th to 20th (left) or 17th to 20th (right), and from here onwards the line continues to the caudal. At the drop an anterior row of scales seems to taper out, so that a continuation backwards of the anterior part of the lateral line would lie in the scale-row above the posterior, but a continuation forwards of the posterior part would lie two rows below the anterior.

OPHICEPHALUS MICROPELTES Cuvier and Valenciennes

Ophicephalus micropeltes Cuvier and Valenciennes, 1831, vol. 7, p. 427 (Java).—Fowler, 1934a, p. 150 (Chiengmai).

Ophicephalus serpentinus Cuvier and Valenciennes, 1831, vol. 7, p. 429 (Siam).

Ophiocephalus micropeltes Günther, 1861, vol. 3, p. 482 (Siam).—Bleeker, 1865 (347), p. 36 (Siam); 1865 (356), p. 174 (Siam).—Sauvage, 1881, p. 160 (Siam); 1883b, p. 151 (Menam Chao Phya).—Weber and de Beaufort, 1922, vol. 4, p. 328 (Siam).—Hora, 1923b, p. 181 (Nontaburi).—Vipulya, 1923, p. 223 (Bangkok).

Ophiocephalus stevensi Bleeker, 1865 (356), p. 174 (Siam).—Sauvage, 1881, p. 160 (Siam).

Ophiocephalus micropeltis Károli, 1882, p. 171 (Siam).

Channa micropeltes Fowler, 1937, p. 224 (Kemarat).

While inhabiting all parts of Thailand this fish is primarily an inhabitant of the larger streams and canals. Its range includes also Indo-China, Malaya, the East Indian islands, Burma, and India.

The fish reaches a length of nearly a meter and a weight of more than 20 kilograms in Thailand. It is thus the largest of the ophicephalids, and combines with its large size a predatory disposition, which makes it one of the most destructive of the local fresh-water fishes. It consumes fishes of all kinds and sizes and also kills far in excess of its actual needs.

There are no special observations on its spawning habits. That it is very savage in guarding its nest and eggs, and will then attack human beings, is well known, however.

As a game fish this species has quite a reputation among anglers in Thailand. It fights hard, sometimes jumps like a salmon after being hooked, and is difficult to land.

The food quality is high but among the Thai is rated below *O. striatus*. The fish are taken to market and kept alive in tubs of water. When a fish is sold, it is stunned by a blow on the head with a wooden club, decapitated with a cleaver just behind the pectoral fins, and the viscera are removed with a narrow median strip of skin and muscle extending from head to vent.

Cuvier and Valenciennes (1831, vol. 7) also described this fish from Thailand under the name *Ophicephalus serpentinus*, basing it on a drawing by Dr. Finlayson. The type, 18 inches long, from the collection of the East India Company, is in the British Museum.

Over most of Thailand this fish is called *pla chado*. In the Bangkok region the usual designation is *pla melang pu*. Along the upper reaches of the Menam Chao Phya young fish bear the name *pla ai pok*.

Order PERCOMORPHI

Family PHALLOSTETHIDAE

The remarkable small fishes of fresh and brackish waters of the Philippines, Malaya, and Thailand constituting the family Phallostethidae have been known less than 30 years and have been recognized as forming a distinct family less than half that time. Material collected in Thailand first raised doubt as to the allocation of this family with the Cyprinodontes by displaying a second dorsal fin, which was overlooked by Regan in his descriptions of the first two genera, *Phallostethus* and *Neostethus*, from Malaya. Recent activities of Herre, Myers, and Aurich have shown that the family is rather extensive and that eight genera are now known. Two of these are represented in Thailand, one of them having a single species peculiar to the country and apparently of very limited distribution in fresh water, the other with species in the Philippines and Malaya and a local species of restricted habitat in brackish water.

The local phallostethids may be recognized readily by the backward position of the 6- to 8-rayed soft dorsal fin, which is preceded by a highly reduced spinous dorsal fin consisting of a single short spine or two short spines; by the absence of ventral fins; and by the presence in the male of a complicated fleshy appendage (priapium) suspended from the head and shoulder girdle, supported by a complex skeleton, having anal, urinary, and genital openings, and bearing certain long, free, slender, curved bony structures presumably used as claspers; one of these bony processes (toxactinium) may project from the anterior part of the priapium, and one or two (ctenactinia) may project from the posterior part. In the female the ventral opening is between the pectoral fins.

In 1935 Myers proposed a new suborder (Phallostethoidea) for these fishes, and in 1940 Berg gave them full ordinal rank under the name Phallostethiformes, recognized the families Phallostethidae and Neostethidae separable on the presence or absence of the toxactinium, and placed them immediately after the Cyprinodontes, to which he considered them related, but as manifesting a step toward the Perciformes.

The two genera of Phallostethidae known from Thailand may be differentiated as follows:

1a. Toxactinium present, its base covered by a shieldlike mass (pulvinulus); posterior end of priapium without soft comblike projections; first dorsal fin with a single spine ________________________________ Phenacostethus

1b. Toxactinium absent; pulvinulus not shieldlike; posterior end of priapium with soft comblike projections; first dorsal fin with two spines in local species (one spine in outside species) ______________________ Neostethus

Genus PHENACOSTETHUS Myers

Phenacostethus Myers, Amer. Mus. Novit., No. 295, p. 6, 1928. (Type, *Phenacostethus smithi* Myers.)

PHENACOSTETHUS SMITHI Myers

Phenacostethus smithi Myers, 1928, p. 6, figs. 1, 2 (Bangkok).—Smith, 1929, p. 13 (Bangkok).—Myers, 1937, p. 138 (Bangkok).—te Winkel, 1939, pp. 59–69, figs. 1–5 (detailed account of internal anatomy).

Phenacostethus thai Fowler, 1937, p. 219, figs. 189, 190 (Bangkok).

When the writer first went to Thailand in 1923, he was attracted by certain small, transparent fishes that inhabited fresh waters within the city of Bangkok, and he saw at once that they were representatives of the extraordinary family that had been brought to light by Regan in 1913 and 1916. They were similar to the species described from the Malay Peninsula as *Neostethus lankesteri* Regan, and the writer assumed they represented that form and published (1927e) a note about them under that name. The next year (1928) Dr. George S. Myers, having examined 19 specimens collected by the present author in 1926, found they differed from *Neostethus* in having no toxactinium and in other characters, and described them as representing a new genus and a new species under the present name. From the account as already published (Smith, 1929), the following notes are taken in part:

> The species abounds in fresh-water pools, ditches, and smaller canals in the Bangkok region, living in water that is nearly always muddy or turbid. It occurs in small, scattered schools that normally remain at or close to the surface, and subsists on planktonic microorganisms. Small numbers put in balanced aquaria did well for a time but ultimately died from starvation as the food supply became exhausted. By the daily introduction of raw ditch or canal water, fish in aquarium jars were kept alive for a month and could doubtless have been sustained much longer. The larvae of anopheline mosquitoes, which are the chief food of most of the small fresh-water fishes of the area, are entirely too large for this fish to ingest, but there is no difficulty in taking minute crustaceans, protozoans, worms, and similar organisms, which swarm in these waters.
>
> The color of the back harmonizes with the water in which the fish live, and they would be difficult to see when at or near the surface were it not for a glistening yellow area on the top of the head; this is of triangular shape, with its apex on the nape. Viewed from the side the fish is transparent, the heart and abdominal viscera are distinctly visible, the vertebrae may easily be counted, and the presence of eggs is readily made out.
>
> The maximum total length of specimens measured was 20 mm., with the females averaging slightly larger than the males. In one lot of 108 adult fish comprising 46 males and 62 females, the largest number of males (28) measured 18 mm. and none of them 20 mm., the largest number of females (30) measured 19 mm. and 10 measured 20 mm.; the average for males was 17.8 and for females 18.7 mm.
>
> It was not possible to make observations on spawning habits. The species is oviparous, and the toxactinium and ctenactinium are undoubtedly used as clasping organs to insure fertilization of the eggs as they are laid in the muddy water. The egg-bearing and spawning periods are protracted, corresponding with the rainy season and subsequent high water in river canals, and may extend from May to December. Fish with enlarged ovaries were observed in July; young 9 mm. long were collected in September and 10 to 12 mm. long in November; and eggs approaching maturity and numbering 67 were dissected from a full-sized fish in November.

The discovery in this species of a short, highly refractive spine, with attached membrane, situated a short distance before the soft dorsal fin raised the question of the systematic position of the Phallostethidae, following the finding of a similar structure in Regan's material for *Neostethus* in the British Museum, and led to the generally accepted allocation of this family with the Percomorphi.

The species called *Phenacostethus thai* by Fowler (1937) based on specimens sent by the writer from Bangkok, can hardly be other than the present species. The differences from the original description are such, as Fowler himself suggested, as might arise from changes caused by preservation.

Genus NEOSTETHUS Regan

Neostethus Regan, Proc. Zool. Soc. London, 1916, p. 2. (Type, *Neostethus lankesteri* Regan.)

NEOSTETHUS SIAMENSIS Myers

Neostethus siamensis Myers, 1937, p. 139 (Chantabun Estuary).

The type and only known specimen of this species, a female 2.87 cm. in standard length, 3.6 cm. in total length, was collected by the writer in April 1933 in the estuary of the Chantabun River, Southeastern Thailand. The fish may be looked for in the lower reaches of the river as well as where the large volume of fresh water from the river mixes with the brackish water of the estuary, and it is very desirable that additional specimens, especially males, be obtained so that Dr. Myers or some other competent student of this group may determine the exact relations of the species.

Family POLYNEMIDAE: Threadfins

Genus POLYNEMUS Linnaeus

Polynemus Linnaeus, Systema naturae, ed. 10, p. 317, 1758. (Type, *Polynemus paradiseus* Linnaeus.)

Numerous members of the family of threadfins are found on the coasts of Thailand, but only one species can be given a fresh-water habitat. A ready means of recognition of the threadfins is the division of the pectoral fins into two parts, the upper composed of normal rays, the lower consisting of free filaments, which may be moved independently and are tactile organs; the number of filaments varies with the different species (3 or 4, 5, 6, 7, and 14). All the polynemids are considered good as human food, and some of the larger forms (genus *Eleutheronema*), attaining a length of 2 meters, are of great commercial importance in the salt and brackish waters.

The general vernacular name is *pla kurao.*

POLYNEMUS PARADISEUS Linnaeus

Polynemus paradiseus Linnaeus, 1758, p. 317 (India).—von Martens, 1876, p. 390 (Menam Chao Phya at Paklat).—Hora, 1923b, p. 177 (Nontaburi, Bangkok).

This species of the coastal waters of India, Burma, Thailand, and Malaya regularly enters fresh-water streams during the spawning season and probably at other times. Locally it is sometimes found in great abundance as far up the Menam Chao Phya as Koh Yai, about 40 kilometers above Bangkok, and ascends also the Bangpakong and other large streams debouching into the Gulf of Siam.

The maximum length is about 25 cm. Full maturity is reached at 17 or 18 cm.

In the fine-meshed set nets (pongpang) operated in the Menam Chao Phya and other rivers, and in the fine-meshed seines hauled at the head of the Gulf of Siam, incredible quantities of adult and young of this species are caught during the rains. At times, between June and September, literally millions may be taken daily, the larger fish being sent to market and the young, from 2 cm. upward, being used as duck feed and fertilizer. Both old and young are of a golden yellow color, with the back gray or green.

The seven detached pectoral filaments are of very unequal length; the three upper may be twice the length of the fish.

In allusion to the sparse chin whiskers worn by the Brahman priests in Thailand, this fish is called *pla nuad pram* (Brahman beardfish).

Family CENTROPOMIDAE

The arrangement proposed by Regan and by Weber and de Beaufort, by which the genera *Lates* and *Ambassis* (*Chanda*) are placed in this family, is here followed. Jordan (1923) assigned these genera to separate families (Latidae and Ambassidae). The differential characters of the two genera here allocated are as follows:

1*a*. Scales ctenoid; parietal and occipital bones with a crest; a supplementary maxillary bone; maxillary reaching beyond eye; preoperculum with a single edge; caudal fin rounded; size large------------------------Lates

1*b*. Scales cycloid; only occipital bone with a crest; no supplementary maxillary bone; maxillary not extending beyond eye; preoperculum with a double edge; caudal fin forked; size small or medium----------------Chanda

Genus LATES Cuvier and Valenciennes

Lates Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 2, p. 88, 1828. (Type, *Lates nilotica* (Cuvier and Valenciennes) =*Perca nilotica* Linnaeus.)

LATES CALCARIFER (Bloch)

Holocentrus calcarifer Bloch, 1790, vol. 4, p. 100 (Japan).

Lates calcarifer Bleeker, 1865 (356), p. 173 (Siam).—Hora, 1923b, p. 176 (Nontaburi).—Vipulya, 1923, p. 223 (Bangkok).—Smith, 1930, p. 56 (Siam).

From the Persian Gulf to Australia and China, this is a well-known and important fish in marine, brackish, and fresh waters. It occurs on all the coasts of Thailand, and it is especially common about the head of the Gulf of Siam and in the streams debouching therein. In the Menam Chao Phya this fish is regularly found as far upstream as Nontaburi or some distance farther. It is most common in the river in March and April, and is much sought by anglers using live prawn as bait.

A length of 1.7 meters is attained by this fish in the Indo-Australian Archipelago, according to Weber and de Beaufort. Examples a meter long are known from Thailand waters, but, owing to active fishing and lack of protection, fish as long as a meter in length have become scarce in recent years.

A few figures showing correlation of length and weight of large examples are available for fish caught in the Ban Yao River, Southeastern Thailand, in April (1924): Length over all, 65 cm., weight 19.8 kilograms; length 75 cm., weight 28.7 kilograms; length 87 cm., weight 33.1 kilograms.

In Thailand this fish may be rated as anadromous; that is, it ascends streams for short distances for the purpose of spawning. There is much information indicating that the lower Menam Chao Phya and various short streams, especially the Paknam Wain and the Ban Yao, in Southeastern Thailand are favorite spawning grounds. The young fish find suitable shelter and food in littoral waters, and grow rapidly.

This is one of the best of the local food fishes, and among both Siamese and foreigners is in high repute. It brings a high price to fishermen and in the retail markets, and is an almost indispensable item on the menu of hotels and formal dinners.

The most extensive special fishery for the *pla kapong* is conducted in short rivers of Southeastern Thailand by Annamite women using hand lines baited with fishes or shrimp. The fishery is active during about 10 months out of the year (April to January), and 4,000 to 6,000 fish weighing 3 to 30 or more pounds are caught in an average year and sent to the Bangkok market in small-stream vessels making regular trips to that section.

The vernacular name for this fish is *pla kapong*. As the same name, with qualifying adjectives, is applied to various sea fishes of somewhat similar appearance, the present species when caught away from the sea is sometimes called *pla kapong nam chut* (fresh-water kapong).

Genus CHANDA Hamilton

Chanda HAMILTON, Fishes * * * River Ganges, pp. 103, 370, 1822. (Type, *Chanda nalua* Hamilton.)

The local fishes of this genus are mostly small, whitish or silvery, some of them translucent, found in salt, brackish, and fresh waters. Some are strictly fresh-water forms, and some occur regularly in both the sea and estuaries and in fresh-water rivers and lakes. In addition to the species herein considered, all of which have been observed in the fresh waters of Thailand, there are several others (*C. myops* (Günther), *C. urotaenia* (Bleeker)) that in other regions are known to enter fresh water and may be looked for in the lower courses of Thailand rivers.

These fishes are eaten locally and sometimes reach the city markets, but they are very bony and their food value is low. They are well known to the fishermen, and throughout their range in Thailand have the name *pla kamao.*

The genus *Chanda*, established by Hamilton (1822) comprised a number of species that in later years have usually been called *Ambassis.* The first unquestioned species named by Hamilton was *C. ruconius; ruconius*, however, is a *Leiognathus* (Lacepède, 1802). *Chanda setifer*, which Hamilton doubtfully referred to his genus, is a *Gerres* (Cuvier, 1829). All the other species, seven in number and congeneric, were adopted by Cuvier and Valenciennes (1828, vol. 2, pp. 175–187) as their own and placed in their genus *Ambassis*, with additional species of their own and of Lacepède. In 1839 Swainson established the genus *Hamiltonia*, as a substitute for *Chanda*, and gave thereunder two species, one, *ovata*, identified as *Chanda nama* Hamilton by Swainson's reference to Hamilton's figure, the other *lata* (an obvious misprint for *Chanda lala* Hamilton, which by another obvious error was assigned the same figure number as *C. nama*). Swain (1882, p. 276) designated *Hamiltonia ovata* as the genotype. The history of *Chanda* became further complicated in 1853 when Bleeker established the genus *Bogoda* and described thereunder a single species ("*Bogoda nama* Blkr."), putting in the synonymy *Chanda nama*, *phula*, and *bogoda* of Hamilton and *Ambassis nama*, *phula*, and *bogoda* of Cuvier and Valenciennes. Bleeker subsequently (1876–77 (301), vol. 8, p. 131) regarded *Bogoda* as a synonym of *Hamiltonia*, but retained the generic name *Ambassis* for various species of the Indo-Australian Archipelago and India, including *Chanda nalua* Hamilton. A still further encroachment on *Chanda* was made by Bleeker in 1874 when he established the genus *Pseudambassis*, with *Ambassis lala* as the type. According to Day (1878) *Ambassis lala* is the young of *Chanda ranga* Hamilton.

From the foregoing statements it would appear that *Chanda* is a valid generic name and that *Ambassis*, *Hamiltonia*, *Bogoda*, and *Pseudambassis* are synonyms of *Chanda.*

Weber and de Beaufort (1929, vol. 5), in their definition of the genus *Ambassis* (i. e., *Chanda*), say: "*Ventrals* * * * without a scaly axillary process." This is an oversight. All specimens of many species examined in Siam (Smith, 1933d) had well-developed axillary scales; and Dr. de Beaufort, when his attention was drawn to the matter, found axillary scales in all of his material in Amsterdam.

The species of *Chanda* known in Thailand may be distinguished as follows:

1*a*. Lateral line continuous.

2*a*. Scales in lateral line 26 to 33; 2 rows of scales on cheeks.

3*a*. Predorsal scales 8 or 9; depth 2.3 to 2.4; interopercle feebly serrated; anal rays III, 8 or 9; second and third anal spines subequal---- kopsii

3*b*. Predorsal scales 17 to 22; depth 2.5 to 2.8; interopercle smooth except for a single spine at posterior angle; anal rays III. 9 or 10; second anal spine longer than third---------------------------- commersonii

2*b*. Scales in lateral line 35 to 46; predorsal scales 25 to 33; 7 or 8 rows of scales on cheeks; interopercle serrated; anal rays III, 9 or 10.

4*a*. Scales in lateral line 35 to 41; depth 2.3; second anal spine equal to third in length and stoutness------------------------------ thomasi

4*b*. Scales in lateral line 43 to 46; depth 1.9 to 2.2; second anal spine much longer and stouter than third------------------------------ wolffii

2*c*. Scales in lateral line 51 to 53; 4 or 5 rows of scales on cheek; depth 2; anal rays III, 13 or 14; second anal spine shorter than third-- siamensis

2*d*. Scales in lateral line 60 to 80; interopercle entire.

5*a*. Scales in lateral line 60 to 70; depth 1.8; anal rays III, 14 to 16; second anal spine as stout as but shorter than third; spinous dorsal fin without a sharply defined black edge------------------------------ ranga

5*b*. Scales in lateral line 70 to 80; depth 2.5; anal rays III, 13; second and third anal spines nearly equal; spinous dorsal fin with a sharply defined black edge-------------------------------------- baculis

1*b*. Lateral line discontinuous, interrupted under eighth dorsal spine and resumed a few scales farther back; 2 rows of scales on cheeks; predorsal scales 13 to 16; scales in lateral line 27 to 30; anal rays III, 8 to 10; second anal spine shorter than third.

6*a*. Supraorbital ridge with 3 or 4 spines on its posterior edge; depth 2.8 to 3.3; least depth of caudal peduncle 1.5 in its length and equal to postorbital part of head---------------------------------- gymnocephala

6*b*. Supraorbital ridge smooth, with a single spine posteriorly; depth 2.3 to 2.7; least depth of caudal peduncle about equal to its length and longer than postorbital part of head------------------------------ buruensis

CHANDA KOPSII (Bleeker)

Ambassis kopsii Bleeker, 1858 (186), p. 253 (Singapore).—Fowler, 1935a, p. 146 (Bangkok).

Fowler (1935a) records from Bangkok this species of the East Indies, Philippines, and Malaya. The writer found it widely distributed in the Gulf of Siam, on both coasts, but always in salt water. It is suggested that the Bangkok specimens referred to by Fowler may have been market fish from the gulf, as fish from the nets in the upper part of the gulf are sent regularly from Paknam to Bangkok by boat and rail.

CHANDA COMMERSONII (Cuvier and Valenciennes)

Ambassis commersonii Cuvier and Valenciennes, 1828, vol. 2, p. 176 (Bourbon, Malabar, Java, Batavia).

Ambassis commersoni Hora, 1924a, p. 485 (Tale Sap).—Weber and de Beaufort, 1929, vol. 5, p. 406 (Siam).

Ambassis safgha Fowler, 1937, p. 232 (Rayong); 1939, p. 41 (Huey Yang).

A species of very wide distribution (Australia, east coast of Africa, India, East Indies, Philippines, and other localities), this species is entitled to a place in this catalog from Hora's record of three young specimens taken in the Tale Sap, and also Weber and de Beaufort record it from Siam. The maximum length appears to be about 10 cm.

Under the name *Ambassis safgha* (Forskål) Fowler (1937 and 1939) recorded the species from Rayong, a fishing village on the coast of Southeastern Thailand and from a brook in the Peninsula. If Forskål's *Sciaena safgha* is identifiable with the present species, *safgha* becomes the proper specific name.

CHANDA THOMASI (Day)

Ambassis thomassi Day, 1870a, p. 369 (Calicut and Mangalore, India).—Hora, 1923b, p. 176 (Menam Chao Phya at Bangkok, Nontaburi).

The only Thailand record for this Indian species is that of Hora, who had before him two specimens from the Bangkok region. In view of Duncker's reporting of the species in Malaya, its occurrence in Thailand is not unexpected.

In India the fish reaches a length of at least 18 cm.

This species was named for H. S. Thomas by Day (1870) who, in the original description and subsequently, used the name *thomassi*. This form is an obvious error.

CHANDA WOLFFII (Bleeker)

Ambassis wolffii Bleeker, 1851 (26), p. 9 (Bandjermassing, Borneo).—Fowler, 1934a, p. 151 (Bangkok).

Ambassis wolffi Bleeker, 1865 (356), p. 173 (Siam); 1876–77 (301), vol. 8, p. 133 (Siam).—Weber and de Beaufort, 1929, vol. 5, p. 401 (Siam).—Fowler, 1935a, p. 144 (Bangkok).

Acanthoperca wolffii Fowler, 1937, p. 230, fig. 227 (Bangkok, Paknam, Tachin).

This fish of the rivers of Borneo and Sumatra is the commonest and most widely distributed member of this genus in Thailand. It has been found in numerous places in the basin of the Menam Chao Phya as far north as Lopburi and in the lower Bangpakong. In November 1923 it was very common in the Sikuk River at Ban Pan in company with *C. baculis*.

It is the largest of the local species, reaching a length in excess of 20 cm. A specimen 18.5 cm. long taken in the Menam Chao Phya at Bang Torani February 6, 1927, was a female with ripe eggs.

The vernacular name in general use is *pla kamao*.

CHANDA SIAMENSIS Fowler

Chanda siamensis Fowler, 1937, p. 230, fig. 228 (Bangkok, Kemarat).

Described from numerous specimens, 2.5 to 6 cm. long, from the Menam Chao Phya at Bangkok and the Mekong at Kemarat, this species may be recognized by the characters indicated in the foregoing key. Its closest relative seems to be *C. ranga*, of India, Burma, and Thailand, which has smaller scales and a deeper body. A ventral axillary scale, described as going 2.8 times in the length of the ventral fin, is not represented in the drawing which accompanies the account of this species. Three specimens 3 to 3.9 cm. long obtained by H. G. Deignan in January 1937 from the Mekong at Chiengsenkao, Northern Thailand, may be referable to this species, although they are slightly more elongate; lateral line tubules 53, dorsal VIII, 13, anal III, 13 and III, 14.

CHANDA RANGA Hamilton

Chanda ranga HAMILTON, 1822, pp. 113, 371, pl. 16, fig. 38 (Gangetic provinces).

This Indian species has once been taken in Thailand waters and may be looked for throughout the Salwin drainage in the Northern and Western districts. Two specimens 6.7 and 7.7 cm. long were obtained in a small affluent of the Pai River at Mehongsorn, Northern Thailand, in June 1932.

According to Day (1876, vol. 1), Hamilton's *Chanda lala* is the young of this species. Bleeker in 1874 (457) made *lala* the genotype of his new genus *Pseudambassis*, which would thus seem to become void.

The local vernacular name for the fish is *pla peer*.

CHANDA BACULIS Hamilton

Chanda baculis HAMILTON, 1822, p. 112 (Ganges).

There has been no previous Thailand record for this species of fresh waters of Burma and India. It has been found to be common in Central Thailand in the Sikuk River, in the headwaters of the Menam Chao Phya at Paknampo, in the lower Menam Nan, and in Bung Borapet and several of its outlets. The fish is recognizable in the field by the intensely black edge on the spinous dorsal fin and the glistening golden spot on the occiput.

This is one of the smallest species of *Chanda*. The maximum length of local specimens has been 4.5 cm.

The vernacular name *pla kamao* is given to this fish as well as to other species of the genus.

CHANDA GYMNOCEPHALA (Lacepède)

Lutjanus gymnocephalus LACEPÈDE, 1802, vol. 3, pl. 23, fig. 3; vol. 4, p. 216 (Sumatra).

Ambassis gymnocephalus FOWLER, 1937, p. 232 (Bangkok, Paknam, Tachin).

The range of this little species extends from East Africa and Australia to India, Malaya, East Indies, Philippines, and China. It was first detected in Thailand in October 1923, when three specimens were obtained in the inner lake of the Tale Sap at Pak Bhayoon, in the Peninsula. More recently Fowler has reported it from the Chao Phya and Tachin Rivers in the Central district. The species, while primarily marine, regularly enters fresh water.

A maximum length not exceeding 7.5 cm. is reported.

CHANDA BURUENSIS (Bleeker)

Ambassis buruensis Bleeker, 1856 (151), p. 396 (Boeroe).—Fowler, 1935a, p. 146 (Bangkok, Keng Sok).

The only record for this fish in Thailand is that given by Fowler, based on three specimens 3.5 to 4.1 cm. long from Bangkok and Keng Sok. The species is otherwise known from Malaya, Philippines, Sumatra, Celebes, and other islands in the Indo-Australian Archipelago.

Family LOBOTIDAE

Genus DATNIOIDES Bleeker

Datnioides Bleeker (85), Nat. Tijdschr. Nederl. Indië, vol. 5, pp. 428, 440, 1853. (Type, *Coius polota* Hamilton.)

The systematic position of this genus has been viewed differently by various ichthyologists. Günther placed it in the Pristipomatidae; Boulenger, Bridge, Jordan, and Weber and de Beaufort in the Lobotidae; and Herre and Myers in the Theraponidae.

Only two species are recognized, from streams and lakes of India, Burma, Thailand, Indo-China, Malaya, and the Indo-Australian Archipelago. They are as follows:

1*a*. Scales in lateral line about 70; rows of scales between origin of dorsal fin and origin of ventral fin about 10 to 12–1–20 to 23; branched dorsal rays 13 or 14; body and head with 8 to 10 dark brown cross bands some of which become confluent with age; a dark round spot on opercle ________________ quadrifasciatus

1*b*. Scales in lateral line about 105; rows of scales between origin of dorsal fin and origin of ventral fin about 20–1–40; branched dorsal rays 15 or 16; body and head with black cross bands, which remain distinct at all ages; no round dark spot on opercle ________________ microlepis

DATNIOIDES QUADRIFASCIATUS (Sevastianov)

Chaetodon quadrifasciatus Sevastianov, 1809, p. 448.

Datnioides polota Bleeker, 1859–60 (239), p. 101 (Siam); 1865 (356), p. 173 (Siam).—Fowler, 1935a, p. 148 (Bangkok); 1937, p. 236 (Bangkok); 1939, p. 49 (Krabi).

Datnioides quadrifasciatus Bleeker (301), vol. 8, 1876–77, p. 32 (Siam).—Hora, 1923b, p. 176 (Nontaburi); 1924a, p. 486 (Tale Sap).—Weber and de Beaufort, 1936, vol. 7, p. 462 (Peninsular Siam).—Koumans, 1937a, pp. 63, 64 (Tale Sap).

The range of this species extends from Ganges to Burma, Thailand, Malaya, and the Indo-Australian Archipelago, in the lower courses of streams, and in coastal lakes. The fish has been taken in small numbers in the Menam Chao Phya in the vicinity of Bangkok and in the Menam Bangpakong, in the Menam Tapi near Bandon, and in the inner lake of the Tale Sap. It is apparently commoner in the last-mentioned locality than elsewhere in Thailand. Specimens from the Menam Chao Phya are in the British Museum.

A length in excess of 25 cm. is attained in Thailand. Fish up to at least 30 cm. long are reported from India and the East Indies. A specimen, 25.5 cm. long, from the Tapi River September 29, 1923, was a male with large gonads.

The appearance of the fish is so different from that of *D. microlepis* that it is always known by different vernacular names. In Central Thailand it is called *pla kapong lai* (*lai*, striped), in the Tapi River *pla kapong sema*, and in the Tale Sap *pla kapong hin* (*hin*, rock). The large basslike fish *Lates calcarifer* is *pla kapong.*

DATNIOIDES MICROLEPIS Bleeker

FIGURE 99

Datnioides microlepis BLEEKER, 1853 (85), p. 442 (Pontianak, Borneo); 1859–60 (239), p. 101 (Siam); 1865 (356), p. 173 (Siam); 1876–77 (301), vol. 8, p. 32 (Siam).

This fish, of striking form and color, inhabits Borneo, Sumatra, Cambodia, and Thailand. Locally it has been reported only from the Central section, in the Menam Chao Phya, the Menam Sak, the Menam Nan, and Bung Borapet.

A length of 40 cm. is attained but the usual size of adult fishes in recent years is under 20 cm.

The general color varies from clear creamy white or pink to pale yellow, pale yellowish green, and light tan, depending on the water in which it is living, whether weedy swamp, lake, or muddy, turbid, or clear stream. Against this background are sharply defined jet black cross bands. Chevey (1932b, p. 68) points out that in the Indo-Australian Archipelago this species has seven bands while on the Asiatic mainland there are 6 bands, the third and fourth bands described and figured by Bleeker (Atlas Ichthyologique) as being fused. Thai specimens conform with those from Cambodia, although there is some variation in the position, shape, and obliquity of the bands. Chevey regarded the mainland fish as a distinct geographic race, but was unwilling to give it a varietal name based on the single color character.

Most of the observations on this fish in Thailand have been made in Bung Borapet. It was the habit of the fish to enter the bung at the period of high water in summer for the purpose of spawning, and to leave during the subsidence of the flood water in autumn. Since the bung has been converted into a vast permanent lake, with the ingress and egress of water and fishes regulated by elaborate barriers, there is for *Datnioides*, as for various other fishes, no necessity to leave, and most of the adults remain throughout the year.

The fish is hardy and soon adapts itself to aquarium life. A fish from Bung Borapet taken to Bangkok was under daily observation for many months. It was very deliberate in its movements, paid no attention to other fish in the aquarium, usually remained quiescent under water plants, and rarely took the normal posture of a fish, that is, the body was kept obliquely, with the head turned either up or down. It thrived on shrimp and raw meat.

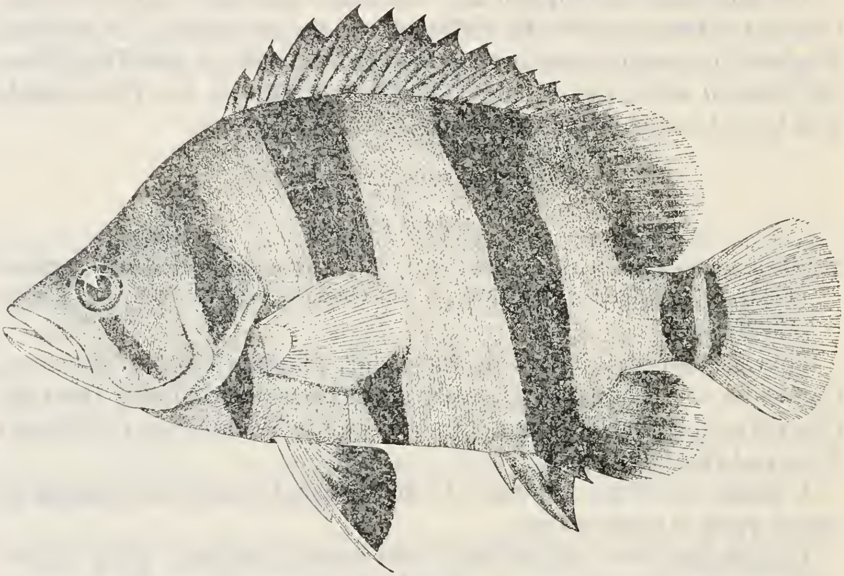


FIGURE 99.—*Datnioides microlepis* Bleeker. Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

The fish has a high reputation for its food qualities, and is in such local demand where caught that only small numbers reach the regular markets. In Bung Borapet the fish is regarded as the most delicious of the local species.

The usual name given to this fish in Thailand is *pla seua taw* (*taw*, stump), and in some sections of the Menam Chao Phya *pla lad*. The Cambodian name is *trey kla* (tiger fish).

Family NANDIDAE

The Thailand members of this family belong in two genera and comprise three species. The outstanding family characters are: Single dorsal fin with 12 to 16 strong spines and very much shorter soft portion containing 11 to 16 branched rays, rounded caudal fin, anal fin with 3 strong spines, ventral fins attached under the pectorals and with a strong spine, compressed body, head and body covered with ctenoid scales which form a sheath for the dorsal and anal spines, lateral line interrupted under the soft dorsal fin and continued several scales lower to the base of the caudal, terminal mouth, which may be strongly or moderately protractile, maxillary exposed, teeth in villiform bands on jaws and palatines, villiform or conical or globular on vomer and parasphenoid, gill membranes united or separate, and opercle with one or several spines.

The two genera may be differentiated by the following characters:

1*a*. Mouth small, slightly protractile, maxillary reaching to vertical from anterior part of eye; nostrils well separated, in an oblique line, posterior very close to eye; gill membranes broadly united; interbranchial space broad and fully scaled; opercle with two flat spines________________ Pristolepis

1*b*. Mouth large, very protractile, maxillary reaching to or beyond vertical from posterior border of eye; nostrils close together, in a vertical line, both close to eye; gill membrane not united, interbranchial space narrow and unscaled; opercle with a single flat spine__________________ Nandus

Genus PRISTOLEPIS Jerdon

Pristolepis Jerdon, Madras Journ., vol. 15 (1848), p. 141, 1849. (Type, *Pristolepis marginatus* Jerdon.)

PRISTOLEPIS FASCIATUS (Bleeker)

Catopra fasciata Bleeker, 1851 (42), p. 65 (Bandjermassing, Borneo); 1865 (347), p. 33 (Siam); 1865 (356), p. 173 (Siam).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Boulenger, 1903, p. 303 (Patani River).

Catopra siamensis Günther, 1862, vol. 4, p. 191, pl. 26, fig. A (Siam); 1864, p. 177 (Siam and Cambodia).—Peters, 1868, p. 257 (Menam).

Pristolepis fasciatus Day, 1876, p. 131 (Siam).—Hora, 1924a, p. 489 (Tale Sap).—Fowler, 1934a, p. 155 (Chiengmai, Hua Mak, Bua Yai, Chantabun, Bangkok); 1934b, p. 351 (Bangkok, Ban Thung Luang); 1935a, p. 153 (Bangkok).—Weber and de Beaufort, 1936, vol. 7, p. 479, fig. 95 (Siam).—Fowler, 1937, p. 242 (Bangkok, Tachin).—Koumans, 1937a, p. 63 (Tale Sap).—Fowler, 1939, p. 75 (Trang).

Catopra nandoides, Sauvage, 1883b, p. 151 (Menam Chao Phya).

Pristolepis fasciata Hora, 1923b, p. 177 (Bangkok).—Vipulya, 1923, p. 224 (Bangkok).

This fish is found throughout the entire length and breadth of Thailand, in rivers, lakes, swamps, and ponds, and in some places it is very abundant. The range extends to Indo-China, Burma, Malaya, and some of the East Indian islands.

In life the general color is greenish or brownish yellow, and although occasional examples show no cross bands, the body in most specimens is marked by 8 to 12 narrow blackish cross bands, most distinct in the young.

The fish is incidentally caught in large quantities in various kinds of apparatus set primarily for other species, and is eaten locally and sent to market. The flavor of the flesh is good, but it is generally regarded as inferior to that of *pla mor* (*Anabas testudineus* (Bloch)).

Prince Vipulya records (1923) that in angling for this fish, worms, prawns, crickets, and grasshoppers are used as bait, and while the usual run of the catch is only 2 to 3 ounces, he has known a fish of 2 pounds to be taken. The largest examples met by the author in Thailand were about 15 cm. long. A length of 20 to 21 cm. is recorded for the East Indies and Burma.

Prince Vipulya writes: "It digs down into the mud of stagnant ponds and on account of its flat appearance is supposed to have been trodden on by elephants going to bathe. Hence the name."

Günther (1862), having specimens obtained in Thailand by Mouhot, described them as new under the name *Catopra siamensis.* Peters (1868) identified under the same name specimens from the Menam Chao Phya. This nominal species must be regarded as coming within the normal limits of variation in *P. fasciatus.*

The usual name given to this fish by fishermen, marketmen, and the general public is *pla mor chang yieb* or *yiep*, sometimes contracted to *pla chang yieb.* In the Peninsula the fish is called *pla patong*, *pla na nuan*, and *pla phrok.* In the upper Menam Chao Phya, a variant is *pla mor nam.* Still another name, *pla takrab*, is heard in the Chantabun region.

Genus NANDUS Cuvier and Valenciennes

Nandus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 7, p. 481, 1831. (Type, *Nandus marmoratus* Cuvier and Valenciennes.)

Small lowland fishes, sometimes entering brackish water, feeding on fishes, shrimps, and insects. Two closely related species are known from Thailand, as follows:

1*a*. Scales in lateral line 46 to 57; scales between lateral line and ventral base 17 to 20; dorsal rays XII to XIV, 11 to 13; anal rays III, 7 to 9___ nandus

1*b*. Scales in lateral line 34; scales between lateral line and ventral base 10.5 to 12.5; dorsal rays XIV to XVI, 11 or 12; anal rays III, 5 or 6__ nebulosus

NANDUS NANDUS (Hamilton)

Coius nandus Hamilton, 1822, p. 96, pl. 30, fig. 32 (Gangetic provinces)

This Indian-Burmese species is very rare in Thailand. The only definite occurrence was a small specimen collected by the writer November 20, 1923, in an outlet of Bung Borapet, Central Thailand. The specimen was sent to Dr. L. F. de Beaufort and the identification was confirmed by him in a letter of June 12, 1925.

The maximum size attained by this species in India is at least 20 cm., according to Day.

NANDUS NEBULOSUS (Gray)

Bedula nebulosus Gray, 1833–34, pl. 88, fig. 2 (no locality given).
Nandus nebulosus Fowler, 1934a, p. 155 (Chantabun) ; 1934b, p. 351 (Ban Thung Luang).

Outside of Thailand, the fish is known from Malaya, Sumatra, Borneo, and other East Indian islands. While found in widely separated localities in Thailand, this species does not appear to be very common anywhere. The first known specimen was obtained by the writer in Bung Borapet, November 20, 1923. The next notice of the fish was in September 1926, when R. Havmöller collected three specimens, the largest 8.5 cm. long, in Huey Sai Nok Riang, a tributary of the river Poon Duang, in Chaiya Province, in the Peninsula. The present author next took three specimens July 4, 1928, in Klong Nakon Noi in the town of Nakon Sritamarat, Peninsular Thailand. In January 1929 a small brook at the base of Kao Sabap near Chantabun, Southeastern area, yielded three specimens, and in April 1920 one specimen was taken in the same stream. A Boy Scout corps sent to the Siamese Bureau of Fisheries two specimens collected in June 1930 at Saiburi on the Menam Sak, central region. More recently, Fowler (1934a, 1934b) has recorded six specimens from Chantabun and two from Ban Thung Luang.

The maximum size represented by Thailand specimens has been 9.7 cm. These were from a stream on Kao Sabap.

Family TOXOTIDAE: Archerfishes

Genus TOXOTES Cuvier and Cloquet

Toxotes Cuvier and Cloquet, Dictionnaire des sciences naturelles, ed. 2, vol. 2 (Suppl.), p. 116, 1815. (Type, *Labrus jaculator* Schneider, *in* Bloch.)

The archerfishes have a wide Oriental distribution. From the Philippine Islands and Australia their range extends through the Indo-Australian Archipelago to Malaya, Thailand, French Indo-China, Burma, and India.

They are readily recognizable by their peculiar shape and color as well as by the extraordinary habit from which they have received their generic and popular names.

The peculiar mechanism of the archerfishes by which they are able to propel drops of water with force and accuracy seems to have been first determined as late as 1936, when Dr. George S. Myers, then acting curator of fishes in the U. S. National Museum, and the writer dissected the mouth parts of specimens of *Toxotes* in the Museum collection and disclosed the anatomical setting.

The three local species are similar in general appearance, size, and feeding habits. All are called *pla seua* (tiger fish) by the Thai, in allusion to the black stripes, bands, or spots on a yellowish background. They are for the most part restricted to the waters of streams and canals near the coast, within tidal limits, but in the Menam Chao Phya they are found at least as far inland as Hangkraben, north of Ayuthia. Another species (*Toxotes blythi* Boulenger), with black longitudinal markings, described from Tenasserim, may occur in the contiguous parts of Thailand.

Three species of archerfishes are known from Thailand, with the following distinguishing characters:

1*a*. Spines in dorsal fin 4; scales in lateral line 28 to 30; scales between dorsal fin and lateral line 4; head and body with about 5 or 6 vertical black bars extending to below longitudinal axis, including a narrow one through eye and one at base of caudal fin________________________________ jaculatrix

1*b*. Spines in dorsal fin 5.

  2*a*. Scales in lateral line 33 or 34; scales between dorsal fin and lateral line 5; head and body with 6 or 7 round or oblong black blotches in an irregular longitudinal series from eye to a point under posterior base of dorsal fin____ chatareus

  2*b*. Scales in lateral line 40 to 42; scales between dorsal fin and lateral line 6; head and body with black blotches or bands variable in number (usually 4 or 5), position, and shape, including one encircling base of caudal fin ____ microlepis

TOXOTES JACULATRIX (Pallas)

FIGURE 100

Sciaena jaculatrix PALLAS, 1766, p. 187 (Batavia, Java).

Toxotes jaculator BLEEKER, 1865 (356), p. 173 (Siam).—SAUVAGE, 1883b, p. 150 (Menam Chao Phya).—SMITH, 1927d, p. 223 (Siam); 1930, p. 58 (Siam).—FOWLER, 1935a, p. 153 (Bangkok, Paknam).—WEBER and DE BEAUFORT, 1936, vol. 7, p. 199 (Siam).

This, the celebrated archerfish of India, Burma, Malaya, the East Indies, Philippines, and French Indo-China, is common in all the coastal regions of Thailand, abounding in estuaries and the mouths of rivers and ascending streams for short distances into strictly fresh water.

A maximum length of 23.5 cm. is recorded by Bleeker. In Thailand examples over 20 cm. long are uncommon.

There appear to have been no recorded observations on the spawning habits of *Toxotes jaculatrix* in Thailand. In the Bangkok region the newly hatched young are seen in May, and by the first week in July a length of 1.3 to 1.5 cm. is attained. At that early age the fishes are very strikingly colored and are conspicuous as they swim at the surface in the turbid river and canal water. The general body color is gray; there are 4 sharply defined black cross bands, one through the eye, one behind the head, one from the front of the first dorsal fin, and one under the second dorsal fin; the dorsal, anal, and ventral fins are black, the caudal and pectoral fins are white.

In Thailand, *Toxotes* is often sought by anglers, who use a light rod and line, armed with a small hook baited with a shrimp or insect. Favorite resorts for the fishes—and hence for anglers—are the inlets and outlets of canals, near locks. A person in a small boat, casting his hook well away from the boat and doing nothing to frighten the fishes, may often catch many at one place. The food value is high.

The species *jaculatrix*, which has received more notice and been under closer observation than other species and may be regarded as typifying all the archerfishes in habits, is one of the most extraordinary and celebrated of Oriental fishes. From an account published by the present writer (Smith, 1936b) on observations made in Thailand, the following excerpts are taken and some additions thereto are made.

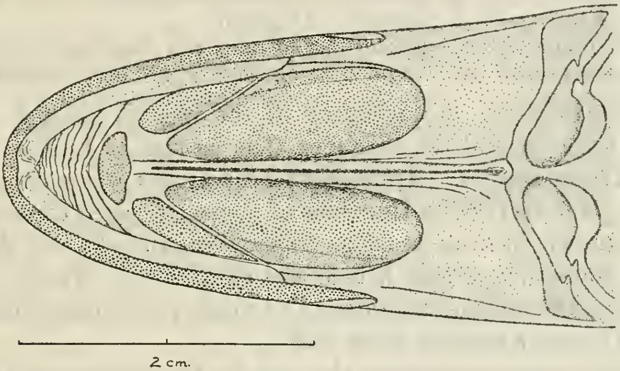


Figure 100.—Upper jaw of *Toxotes jaculatrix* (Pallas). Drawn by Miss Jane Roller.

In the eighteenth century and earlier, vague accounts reached Europe regarding an Oriental fish that obtained its food, consisting of insects, by knocking them down with drops of water propelled from its mouth. These accounts, unsupported by reliable evidence, doubtless met with a mixed reception on the part of zoologists and the general public; and it may be imagined that the scientific world of that day was eager to obtain authentic information concerning a creature whose behavior was so different from that of any other known fish.

The first definite printed reference to the fish in a European language seems to have been published in the year 1765, in the Philosophical Transactions of the Royal Society of London. At a meeting of the society held on March 15, 1764, a communication was read from John Albert Schlosser, M. D., F. R. S., of Amsterdam (1765), announcing the presentation to the society of a specimen of the fish which, to quote him, "I believe, hath never been observed by any writer on natural history." The communication carried a description of the peculiar habits of the fish on the authority of a Mr. Hommel, governor of a hospital in Batavia, who was also the collector of the specimen. Designated as "the jaculator or shooting fish, a name alluding to its nature," the creature was described as follows:

> It frequents the shores and sides of the sea and rivers, in search of food When it spies a fly sitting on the plants, that grow in shallow water, it swims on to the distance of four, five, or six feet, and then, with surprizing dexterity, it ejects out of its tubular-mouth a single drop of water, which never fails striking the fly into the sea, where it soon becomes its prey.
>
> The relation of this uncommon action of this cunning fish raised the governor's curiosity; though it came well attested, yet he was determined, if possible, to be convinced of the truth, by ocular demonstration.
>
> For that purpose, he ordered a large wide tun to be filled with sea-water; then had some of these fish caught, and put into it, which was changed every other day. In a while, they seemed reconciled to their confinement; then he determined to try the experiment.
>
> A slender stick, with a fly pinned on at its end, was placed in such a direction, on the side of the vessels, as the fish could strike it.
>
> It was with inexpressible delight, that he daily saw these fish exercising their skill in shooting at the fly, with an amazing velocity, and never missed the mark.

Unfortunately for the accuracy of the record, the fish to which Hommel referred and the specimen that he sent to London were entirely different species. Appended to the article was a copy of a description given in 1754 by Linnaeus of a species called *Chaetodon rostratum* (known in later years as *Chelmo rostratus*), and the accompanying plate was of that fish of the coral reefs. There were thus precipitated the misunderstanding and doubt concerning this fish that lasted for nearly a century and a half.

A second communication on this fish by Dr. Schlosser (1767) contained a description in Mr. Hommel's own words and gave additional information on the fish's peculiar habits. Dr. Schlosser at this time presented another specimen, and a description of it under the name *Sciaena jaculatrix* was given by the German zoologist Pallas. A poor but easily recognizable illustration accompanied the article. The allocation of the species with the sciaenid fishes was unfortunate, and in 1817 Cuvier corrected the error and established the genus *Toxotes* for its reception.

During practically the whole of the nineteenth century there seem to have been no new observations on the shooting powers attributed to the archerfish and no confirmation of the statements made by Hommel in 1765 and 1767. On the contrary, the leading authorities on Oriental fishes denied that the fish did or could perform as claimed.

Dr. Pieter Bleeker, who spent more than 35 years studying the fishes of the Orient, was the author of more than 400 volumes and papers thereon, and was long a resident of the same city (Batavia) as Hommel. He was unable to verify the early accounts of the jaculator fish and in 1875 expressed the belief that it did not deserve the celebrity that had been imposed on it and that its reputation was based on error of observation.

Dr. Francis Day, who devoted more than a quarter of a century to the investigation of the fishes of India and Burma and published monumental works thereon, withheld from *Toxotes* any credit whatever for its extraordinary shooting ability and erroneously ascribed to the coral-reef fish *Chelmo* the same ability.

The original cause of misunderstanding as disclosed by the early publications, and the perpetuation of the error by Bleeker, Day, and others, was doubtless due, in part at least, to the fact that among the Malays both *Toxotes* and *Chelmo* are called by the same name, *sumpit-sumpit* (from *sumpitan*, a blowpipe).

Several minor articles on the habits of *Toxotes* appeared in European periodicals in the last 2 or 3 years of the nineteenth century, but it was not until the twentieth century had dawned that this fish may be said to have come into its own. Observations of the Russian ichthyologist Zolotnisky on the behavior of the fish in captivity fully established the long-disputed habits. Zolotnisky's (1902) article was made the basis for a critical review of a paper by Dr. Theodore Gill (1909). The following facts regarding *Toxotes* were recorded by Zolotinsky and have since been largely confirmed, although Gill found it difficult to accept some of them:

> (1) The fish subsists largely on insects, which hover over the water or rest on overhanging vegetation. When a fish approaches within a certain distance of an insect, it becomes stationary, points its head and turns its eyes directly at the prey, brings the front of its mouth to the surface of the water, partly opens the mouth, and forthwith propels a drop, or several drops of water at the insect, which ordinarily is 12 to 20 inches distant, but may be 40 inches or more. The aim is true and the insect falls into the water and is at once devoured.
>
> (2) The fish frequently swims backward. This habit is often observed when the fish reconnoiters a prospective prey, and backs from it in order to secure a good position for observation and attack.
>
> (3) The eyes sparkle with seeming intelligence and their mobility is noteworthy. They can be directed laterally, upward, and backward, but may not be turned downward.
>
> (4) Aerial vision is acute. Even small insects may be seen at a great distance and fall a prey to the fish's amazingly accurate aim.
>
> (5) Discrimination and selection are apparently exercised in the choice of food; considerable ingenuity is sometimes employed in obtaining food; and in shooting at insects the distance and the force are gauged.

In recent years in America many people have become acquainted with the archerfish and its performances through examples in aquaria in New York, Philadelphia, and other cities; and a motion picture of a fish in action has been made at the New York Aquarium. The present generation of fish students everywhere may be pardoned for expressing surprise at the protracted skepticism, and wonder at the failure of doubting Oriental ichthyologists to conduct practical tests.

The doubt shown by zoologists of the last century in regard to the reputed shooting powers of the fish was partly due to their failure to detect in the fish's mouth any special mechanism by which drops of water could be formed and expelled. It is, of course, obvious that that there must be some peculiar adaptation or apparatus in *Toxotes* to account for its extraordinary accomplishment. By carefully watching the fish at close range on many occasions in Thailand, the writer formed an opinion of the probable propelling mechanism, and subsequently verified that opinion by holding the fish in a basin or bucket of water in the position regularly assumed when shooting and making them perform almost at will. This he accomplished by the quick, forceful compression of the gill covers with his fingers, and by so doing he was able to cause a fairly satisfactory imitation of the normal shooting act, and had no difficulty in propelling drops of water for distances up to 3 feet.

This compression of the gill covers would in itself not account for the escape from the mouth of water in the form of individual drops of uniform size, and it is to the peculiar shape and structure of the mouth parts that we must look for the additional factors necessary for the complete and perfect performance.

The mouth cavity of *Toxotes* is long but its diameter is much restricted by the projecting sides of the roof and by the large tongue, which when raised may completely close the passage to the pharynx. The anterior part of the tongue is free from the floor of the mouth, and its rounded tip is of paperlike thinness and fits snugly against the palate; posteriorly the tongue is thick, bears minute teeth, and has a conspicuous fleshy prominence. Extending along the median line of the roof of the mouth, from a point just behind the band of vomerine teeth to the pharynx, is a deep groove which, when the tongue is applied to the roof of the mouth, becomes converted into a tube. This groove-tube, which in a fish 7 inches long is less than a sixteenth of an inch in diameter, not previously described or referred to in ichthyological writings, may readily be seen when the tongue is depressed. That it should have been so long overlooked is something of a mystery when one recalls the vain efforts made by Oriental ichthyologists to discover any special adaptation for drop shooting.

It is not difficult to discern the manner in which the shooting fish operates. With its tongue closely pressed against the palate, the sudden compression of the gill covers will force water from the pharynx into the palatine canal, and with the tip of the tongue acting as a valve, the flow of water under pressure from the anterior end of the tube is regulated. With the jaws partly separated and the mouth reaching or projecting slightly above the surface, the water is ejected with a force and for a distance that depend on the pressure. It is easy to understand how, with the pharyngeal cavity serving both as a reservoir for water ammunition and a compression chamber, it is possible for the fish to shoot drops of water in quick succession, to propel the water in the form of a jet when the valve is kept open longer.

The drop-propelling function would be useless if *Toxotes* did not possess, in addition, the ability to use its eyes in the air and to gauge accurately the distance, size, and suitability for food of small creatures flying or resting near the water's edge. It is an outstanding point that, for a fish, the aerial vision of *Toxotes* is very keen, and it was always a surprise to the present author to note the readiness with which insects and spiders were sighted as the fish explored the vegetation on the bank of a pond or stream.

The archerfish, with shapely, compressed body propelled by its broad caudal fin, is a graceful swimmer, moving quickly without apparent effort. It regularly swims at or just below the surface, and may go a long distance in a perfectly straight line, making a wake with the tip of its jaws. This wake is characteristic and enables an observer to detect the presence of a fish before he has actually seen it. The habit of swimming at the surface is ascribable to two circumstances: The food on which the fish chiefly subsists is obtainable there, and the eyes, on which the fish largely depends, could not otherwise function properly, for during most of the year the waters in which *Toxotes* lives are very muddy or turbid and aquatic vision is much restricted.

While *Toxotes* prefers the live food that it shoots for itself, it regularly eats shrimps, insect larvae, and other creatures living in the water and insects that have fallen into the water. A large nest of carpenter ants impaled on a stake in a pond provided food for fish for several days as the ants fell into the water and were eagerly devoured. Under both semidomesticated and wild conditions the fish does not reject bits of raw and cooked meat, fish, crabs, and prawns. Specimens that the writer kept in a pond regularly came to be fed on raw chopped pork and fish. The cavity of this fish's mouth is too narrow and the sides are too rigid to permit the passage of a large mass of food; and it is apparent that seized insects and other food must first be reduced to a slender bolus between the tongue and the various bands of minute teeth on the roof of the mouth before swallowing is possible.

Some of the standard modern works of reference and textbooks make inadequate allusion to the exercise of the shooting power. Thus, when Boulenger (1904, p. 658) stated that "*Toxotes jaculator* derives its name from its habit of capturing insects flying near the surface of the water by shooting drops of water at them," he overlooked the much more common and characteristic habit of stalking insects that are resting on plants in the water or at the water's edge. In reality, insects shot on the wing represent a very small percentage of the total food intake. The fishes will, however, sometimes become very active in shooting at insects on the wing. One day in April, after a heavy rain, large winged termites appeared in great numbers in the yard of the author's residence in Bangkok and many flew low over a pond into which *Toxotes* had been introduced. The fishes were observed to follow the termites with great eagerness and often bring them down with a single shot or a series of shots. Marksmanship at moving insects was not nearly so accurate as when exercised against insects at rest on overhanging vegetation. On this occasion, when termites flew within a foot of the surface of the pond. the fishes sometimes jumped entirely out of the water, and caught them on the wing.

The range, accuracy, and force of the shooting powers of *Toxotes* always cause surprise and admiration. In the author's experience in Thailand the distance within which the fish could always be depended on to score a direct hit was 3½ to 4 feet. A much longer effective range has been recorded. Two fishes in the New York Aquarium could without difficulty hit a small cockroach at a measured height of 5 feet above the water.

Failure to hit a resting insect within proper range may be due to movements of the vegetation or, in the case of a spider dangling on a thread, to swaying caused by wind. When the first shot misses a mark, other shots usually follow in quick succession.

The force with which the watery pellets may strike an object is sometimes most astonishing to a human observer. An insect may be knocked high in the air or may fall on the bank beyond a fish's reach. At short range the drops may strike a person's face with a distinctly stinging sensation. On many occasions, during exhibitions in Thailand, a spider at the end of a thread hanging from the end of a pole was knocked far up on the thread or even over the pole.

The shooting habit begins to develop early and may be observed in fishes only an inch long. It is most amusing to see the inexperienced youngsters emulating the actions of their parents and sending out tiny drops that may go only 2 or 3 inches. In half-grown fish the habit is well developed, but the highest expression of the shooting powers as regards accuracy, force, and range is to be seen only in the fully matured fish.

A peculiar feeding trait was exhibited by both river fishes and pond fishes in Thailand when a spider on a thread was lowered to within about a foot of the surface of the water. A fish, which may have been shooting at the spider when it was 2 or 3 feet distant, would with little apparent effort rise vertically from the water and seize the lure in its mouth, sometimes holding on when the line was raised several feet. This was done so readily and regularly as to suggest a normal habit, although as a matter of fact I never saw it tried on insects hovering near the surface or resting on plants. Probably spiders and caterpillars hanging from their threads are the principal victims of this method of attack.

Among all the Oriental fresh-water fishes with which the writer is acquainted in the wild state, none gives such an impression of intelligence and efficiency as does *Toxotes.* This impression grows on an observer as he notes the purposeful way in which a fish moves about in a stream, canal, or pond; the zeal and thoroughness with which it explores aquatic and overhanging land plants for insects; the high development of its sense of sight in both air and water; the skill displayed in dislodging insects and seizing them as they fall into the water; the alertness in avoiding danger; and the readiness in adapting itself to life in small ponds and responding to the attentions of persons who provide food.

TOXOTES CHATAREUS (Hamilton)

FIGURE 101

Coius chatareus HAMILTON, 1822, pp. 101, 370, pl. 14, fig. 34 (mouths of the Ganges).
Toxotes chatareus HORA, 1924a, p. 491 (Tale Sap).—FOWLER, 1937, p. 246, figs. 251–258 (Bangkok); 1939, p. 52 (Krabi).
Toxotes chatereus WEBER and DE BEAUFORT, 1936, vol. 7, p. 203 (Siam).

The distribution of this species in Thailand corresponds with that of *T. jaculatrix.* It is particularly common in the upper lake of the Tale Sap, where many specimens have been collected. Material has been examined also from the Tapi River near Bandon, the Meklong at Rajaburi, the Menam Chao Phya from its mouth as far up as Ayuthia, and

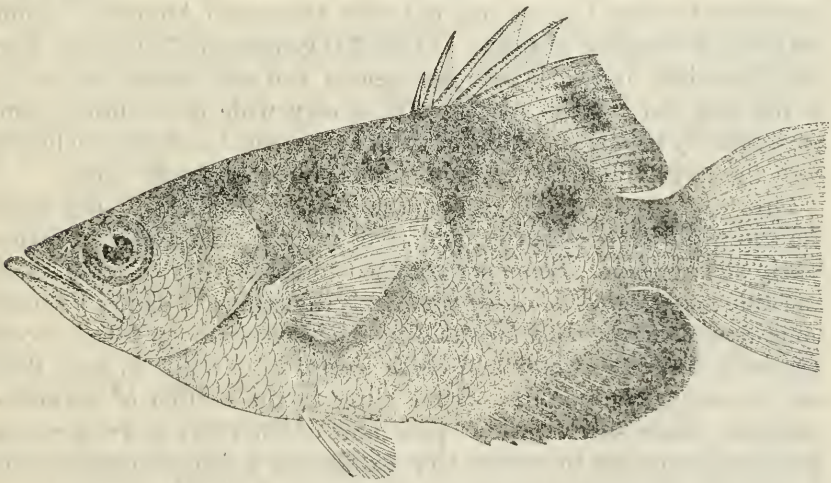


FIGURE 101.—*Toxotes chatareus* (Hamilton). Drawn by Luang Masya; courtesy of the Thailand Government.

the lower Bangpakong. Besides being found in the Indo-Australian Archipelago, Malaya, French Indo-China, and India, this species extends its range to Northwest and South Australia.

A length of 27 cm. is reported by Weber and de Beaufort, but examples 20 cm. long are uncommon in Thailand, the largest specimens examined have been 15.5 to 16 cm. long. Full maturity is attained at a length of 10 cm.

TOXOTES MICROLEPSIS Günther

Toxotes microlepsis GÜNTHER, 1860, vol. 2, p. 68 (Siam) ; 1864, p. 174 (Siam and Cambodia).—BLEEKER, 1865 (356), p. 173 (Siam [after Günther]).—SAUVAGE, 1883b, p. 150 (Menam Chao Phya).—HORA, 1923b, p. 177 (Bangkok, Nontaburi).—FOWLER, 1934a, p. 155 (Bangkok).—WEBER and DE BEAUFORT, 1936, vol. 7, p. 202 (Siam).

Originally described from specimens collected in Thailand by Mouhot, this species has since been found in Borneo and Sumatra. It may be recognized easily among the local species of *Toxotes* by the small scales, 40 to 42 in the lateral series and 20 or 21 in crosswise series.

T. microlepsis is a river fish, and in Thailand it seems to push its way farther inland than do the other species. It is common in the lower Menam Chao Phya and it is found regularly as far north as Ayuthia and Hangkraben. Specimens have been examined also from the Nakon Nayok, one of the branches of the Bangpakong.

A length of 15 cm. is attained by the local specimens.

Order GOBIOIDEA: Gobioid Fishes

The gobies constitute a rather diversified group occurring in Temperate and Tropical Zones throughout the world but especially well represented in the Tropics, and only the Arctic and Antarctic regions are entirely destitute of them. About 300 genera and 700 species have been described, and each year new genera and new species are added to the long list. Some species have a very wide distribution, some are markedly localized. Most of them are marine but many, including both the largest and the smallest forms, frequent fresh water.

They are mostly small, carnivorous bottom dwellers, living along the shores of bays, estuaries, and river mouths, and also in streams, lakes, and swamps. Some are confined to coral reefs or coral heads and tide pools, some lie on or are partly concealed in sandy bottoms, some are among the most outstanding mud lovers among fishes. Some regularly leave the water and chase insects on strand, on mud flats, and in mangrove swamps. Some cling to the bottom of turbulent streams. Some species, which pass most of their life in fresh water, go down to the sea to spawn, thus exhibiting a definite catadromous habit such as shown by the common fresh-water eels (Herre, 1927).

Outstanding and invariable physical features of the gobies are the insertion of the ventral or pelvic fins in the thoracic region, under or in advance of the pectorals, and the absence of a lateral line. The shape of the ventral fins is a prime character used in the classification of families, genera, and species in combination with the shape and structure of the fins, the dentition, and the squamation. Osteological characters of the order include the small number of vertebrae (not exceeding 37) and reduction or even vestigial condition of the scapula and coracoid.

The number and arrangement of the cutaneous papillae and pores on the head in the gobies are very important in the study of the genera and species. The subject is worthy of much more attention than has heretofore been given except by a very few modern ichthyologists, among whom may be especially mentioned Luigi Sanzo (1911) and Isaac Ginsburg, of the United States Fish and Wildlife Service. In the present work it has not been possible to devote to the subject the detailed study that is required in order to cover it thoroughly, but it is known that many of the Oriental gobies, including those of Thailand, present features of special interest in the development of the systems of pores and papillae, and it is hoped that qualified students may find opportunity to devote the necessary time and effort to the elucidation of these organs, not neglecting their functions.

The nomenclature, taxonomy, and classification of many Oriental gobies have been much involved. Important contributions to the classification of Pacific and Oriental gobies have been made by Jordan, Seale, Snyder, Fowler, Herre, Koumans, and others, but much remains to be done before a wholly satisfactory correlation of Indian, Burmese, Thai, Malayan, Indo-Australian, Philippine, and Chinese forms can be achieved.

In no other order of fishes does there exist such an opportunity to add to the knowledge of the fish fauna of Thailand as in the gobies. It is certain that many new or rare forms remain to be discovered, and even among well-known species much valuable information may be acquired in regard to habits, spawning, growth, variation, and other characteristics.

Mention may be made here of a paper of special interest by Prof. A. S. Pearse (1933), dealing chiefly with four goby species common on the mud beaches near the mouth of the Menam Chao Phya. The gobies are considered with reference to their ecology, evolutionary tendencies, and parasites, and the following paragraphs are extracted from Pearse's very valuable paper:

> The beach-skipping gobies are of particular interest because they are at present in the very act of becoming land animals. They live on wet, mucky beaches but are veritable terrestrial vertebrates and may live for several days out of

water. * * * The beach-skippers or mud-skippers, though they do not wander far from water, have eyes well adapted for vision in air. In this respect they are better adjusted to land life than species, such as the climbing-perch (*Anabas testudineus*), which often make long journeys overland but nevertheless have eyes adapted for seeing in water. * * * Their eyes are better suited for distant perception than those of fishes which are active in water. The fins and tails of beach-skippers are also adjusted to locomotion in air. An active goby can progress much faster than a man over a mud flat. The skins of such fishes are thicker than those of aquatic gobies and thus conserve water. * * * The respiratory organs show anatomical and physiological adaptations for breathing in air. * * *

Four species were studied in some detail * * * *Periophthalmus koelreuteri* (Pallas), *Periophthalmodon schlosseri* (Pallas), *Boleophthalmus boddaerti* (Pallas), and *Glossogobius giuris* (Hamilton).

The first three species lived on the mud flats, the third usually somewhat lower down than the first and second, but all three went up and down together with the tides and even invaded the zone above high-tide mark, where they hunted for food among mangrove roots and hydrophytic plants. The first species was a strictly aquatic goby, which never came out of the water. In Java, Harms * * * found beach gobies arranged in more or less definite zones. This was not true of the three common species at Paknam, which continually mingled together. Though these fishes lived together, they were not competing to any extent. They were different in size, food, length of intestine, and type of parasites. * * *

The long-intestined, vegetarian *Boleophthalmus* was the only fish which harbored intestinal flagellates. This agrees with the observation of Hegner * * * on the relation of diet to flagellate infestation in mammals. Tapeworm and acanthocephalan cysts were present only in the largest land gobies. Adult nematodes, tapeworms, trematodes, acanthocephalans, copepods, and *Spinitectus* cysts were found only in the aquatic goby. * * * Agamofilaria cysts occurred in the carnivorous land gobies. Parasitic isopods * * * were often encountered on the gills of all the gobies, but were most abundant on the aquatic species. The largest land goby [*Boleophthalmus*] was most often infested with parasites; but the largest number of parasites per individual and the largest number of species of parasites occurred on the aquatic goby. Perhaps the former was more often infested because it visited a greater variety of habitats; perhaps the latter contained more parasites per individual because it lived continually in water and was thus susceptible at all times to aquatic parasites. By taking up land life, gobies appear to have escaped from certain types of parasites.

Land gobies have also attained other desiderata by becoming terrestrial. They move faster in air than in water and can thus, with their peculiarly adapted eyes and limbs, seek food and escape enemies better than their aquatic relatives. They probably escape some aquatic enemies besides parasites when they leave the water. They also encounter new dangers in the way of astute enemies and parasites. For example, the Agamofilaria cysts which occur in land gobies probably come to maturity in fish-eating birds or mammals.

When a fish changes from an aquatic to a terrestrial mode of existence, profound changes in its anatomy and physiology must take place. These must, in such a highly organized animal as a fish, be accompanied by modifications in the nervous system. * * * During past ages aquatic vertebrates undoubtedly gave rise to land vertebrates. It appears probable that many aquatic types were able to breathe air before they attained land life, probably as an adaptation to lack of oxygen in shallow, stagnant bodies of water. * * *

> In speculations as to how and why animals have left the stable, dependable ocean in order to take up a precarious existence in highly variable land habitats, various factors have been stressed. Doubtless enemies, desirable foods, lack of oxygen, reproduction, and other things have been more or less effective as contributing causes to such migrations. The writer * * * has suggested that an important factor in the adjustments of animals to land life is the avoidance of interspecific competition. Many species of animals along the shores of oceans are arranged in definite zones and thus avoid competition. * * * Incidentally, some of them acquire such qualities that they can live on land. The species of beach gobies at Paknam are not arranged in definite zones but compete very little with one another because they are somewhat specialized in their food habits. They are thus together but not segregated. Wherever there is vacant territory or habitat in nature there is a chance for a new species. Safety, unconsumed resources, lack of competition, desirable breeding places, and other desiderata make the enduring of new hardships expedient. Thus land animals have evolved because certain types could avoid old competitions by acquiring new ranges of adjustment so that they could live in vacant habitats.

In Thailand as in various other tropical or subtropical countries the size, abundance, and food value of the gobies make them of considerable economic importance. In the Philippines and elsewhere the newly hatched young on their way from the sea back to the stream from which their parents migrated are taken in immense quantities and are the basis of an important industry.

Rather than attempt to separate the species living in fresh and in brackish waters from those in brackish and salt waters, it has been thought advisable in the case of the present order to depart from the general treatment observed in the catalog and to enumerate all the known local species. These are included in the following genera and subgenera:

1*a*. Form not eellike; dorsal fins separate (rarely united at base).
  2*a*. Eyes not stalked; no free movable lower eyelid; teeth in one or several to many rows in each jaw; pectoral fins with no noteworthy muscular development at their base.
    3*a*. Ventral fins close together but not joined------------------ **Eleotridae**
    3*b*. Ventral fins united and having across their base a membrane or frenum which forms a sucking disk, or basal membrane partly or wholly deficient-- **Gobiidae**
      4*a*. Body more or less elongate; head and body compressed or depressed; head scaleless or partly scaled; body scaleless, partly scaled, or fully scaled; gill openings restricted to sides or extending more or less forward; ventral fins united into a disk or joined basally with or without a connecting membrane.
        5*a*. Teeth in several rows in each jaw (in one row in upper jaw in *Oxyurichthys*-- **Gobiinae**
        5*b*. Teeth in a single row in each jaw----------------------**Sicydiinae**
      4*b*. Body elliptical and strongly compressed; head and body entirely scaleless or body covered with large ctenoid scales; gill openings restricted to sides; ventral fins short, united into a disk or tube. **Gobiodontinae**

2*b*. Eyes on short stalks and erectile above surface of head; lower eyelid free and movable; teeth in upper jaw in one or two rows; teeth in lower jaw in one row, with no postsymphyseal canines; pectoral fins with a strongly developed muscular base; second dorsal fin with 12 to 15 branched rays ---------------------------------- **Periophthalmidae**

2*c*. Eyes on short stalks or not; lower eyelid free and movable or not; teeth in upper jaw in one row; teeth in lower jaw in one horizontal row, with or without a pair of postsymphyseal canines; pectoral fins without a strongly developed muscular base; second dorsal fin with 13 to 31 branched rays ---------------------------------- **Apocrypteidae**

1*b*. Form very elongate and more or less eellike; a single very long dorsal fin, anal fin very long, both joined to caudal or closely approximated thereto -- **Gobioididae**

6*a*. Ventral fins completely united into a funnel-shaped disk or more or less separated and joined only at their base; above each opercle a slit opening into a blind pouchlike cavity --------------- **Trypaucheninae**

6*b*. Ventral fins united; no pouchlike cavity above opercle ------ **Gobioidinae**

Family ELEOTRIDAE: Sleepers

The eleotrid gobies are characterized, among other features, by the more or less complete separation of the ventral fins, which never form a disklike sucking organ. They abound in bays and the mouths of rivers, but some live exclusively on marine reefs, and some push their way into the fresh parts of rivers or even into fresh-water lakes. Those that have at times a fresh-water habitat are believed generally to go into salt water to spawn. By far the largest of the gobies belong in this family.

These fishes lie quietly on the bottom, and are able to obtain protection by adapting their color or color pattern to the surrounding bottom.

Many of the local individuals of salt-water genera have a tendency to push their way into the brackish or fresh parts of coastal streams; and in order to render the treatment of the whole family more complete all the genera represented in Thailand are included. They may be differentiated as follows:

1*a*. Ventral fins with 4 branched rays; body very elongated and strongly compressed; scales very minute, embedded, cycloid, covering body posteriorly; no scales anterior to first dorsal fin; mouth very oblique; teeth small, pluriserial, none canine or caninoid; dorsal rays VI, 16; anal rays 15; caudal fin with several rays produced into filaments ----------- **Herreolus**

1*b*. Ventral fins with 5 branched rays.

2*a*. Preopercle armed with a single decurved spine, which may be concealed --- **Eleotris**

2*b*. Preopercle unarmed.

3*a*. Vomer with a semioval patch of minute teeth; a large black white-edged ocellus at upper base of caudal fin; scales very small (130 to 140 in longitudinal series) ------------------------------- **Bostrichthys**

3*b*. Vomer without teeth.
  4*a*. Head with bony crests in interorbital space and around eyes; scales in longitudinal series 26 to 30; a large black spot at base of pectoral fin with two small white (pink) spots in the anterior part of the black spot.
    5*a*. Head long, pointed, its depth equal to its breadth; lower jaw strongly projecting; supraorbital ridge low and smooth or nearly so_ **Butis**
    5*b*. Head short, obtuse, its depth less than its breadth; lower jaw very slightly or not projecting; supraorbital ridge strongly serrated. **Prionobutis**
  4*b*. Head without bony crests in interorbital space and about eyes.
    6*a*. Canine teeth absent.
      7*a*. Scales in longitudinal series 30 to 40; branched rays in dorsal and anal fins 7 to 9________________________________ **Ophiocara**
      7*b*. Scales in longitudinal series 60 to 90; branched rays in dorsal and anal fins 8 to 10________________________________ **Oxyeleotris**
    6*b*. Canine teeth present.
      8*a*. Lower jaw with one or several pairs of posterior canine teeth; scales ctenoid, 70 to 110 in longitudinal series; branched rays of dorsal and anal fins 11 to 18__________________ **Valenciennea**
      8*b*. Lower jaw with one or two pairs of canine teeth behind symphysis; scales cycloid, 110 to 170 in longitudinal series; branched rays of dorsal and anal fins 19 to 32____________________ **Ptereleotris**

Genus HERREOLUS H. M. Smith

Herreolus H. M. Smith, Journ. Siam Soc., Nat. Hist. Suppl., vol. 8, p. 190, 1931. (Type, *Herrea formosa* H. M. Smith.)

The name *Herreolus* (Smith, 1931d, September), was proposed for *Herrea* (Smith, 1931a, March), which had been preoccupied by Whitley in 1930. Another substitute for *Herrea*, namely, *Herreichthys*, was proposed by Koumans (1931), but that designation is an undoubted synonym of *Herreolus*. Koumans' paper bears no date of publication but the title page indicates that proof sheets were offered to the faculty of science and natural history of the University of Leiden December 4, 1931, which would be the earliest possible date assignable to the publication.

The original description of this genus was defective and incorrect in a number of important elements. For instance, the definition left doubtful the actual family, whether Gobiidae or Eleotridae, to which the fish belongs. For this reason it is deemed desirable to offer a new generic description and to indicate relationships.

The genus *Herreolus* is an eleotrid, having the ventral fins entirely separate. The body is very elongate, and both body and head are strongly compressed. The head is of moderate size, blunt, with large eye, wide and flat interorbital, short snout, and very oblique mouth, with maxillary extending to a point under anterior margin of eye. The teeth are small and pluriserial, those in the outer row of the lower jaw enlarged but not caninoid. The gill openings are restricted to the sides opposite the base of the pectoral fins, and the isthmus is correspondingly broad. Posteriorly to the front of the dorsal fin the body is covered with extremely minute cycloid scales, and the predorsal region and head are naked; a row of large pores surrounds the eye. The dorsal fins are contiguous, the first having 6 spines, the second 16 rays in the type species. The caudal fin is rounded, and one or two of the median rays in each lobe are produced into short filaments. The anal fin is like the second dorsal and has 15 rays. The ventrals are rather long and pointed and consist of a spine and 4 branched rays. The pectorals are of moderate length, with broad base, and contain 16 rays.

The possession of only 4 branched rays in the ventral fins separates *Herreolus* from all the other local eleotrid gobies and associates this genus with a small Oriental group of which *Oxymetopon* Bleeker (1861), *Orthostomus* Kner (1868), and *Vireosa* Jordan and Snyder (1901) are other members. The single American genus, *Ioglossus* (Bean, 1882, Gulf of Mexico), was placed by Jordan and Gilbert (1882) in the subfamily Oxymetopontinae on the basis of 4 branched ventral rays, and the Oriental eleotrids with the same feature of the ventral fins are obviously referable to the same subfamily. The relations of *Herreolus* with the related Oriental genera are indicated as follows:

1*a*. Chin with a large flat median barbel, which is followed by several smaller barbels; body covered with minute embedded cycloid scales, head naked; teeth in upper jaw in 2 series, the outer consisting of a few fanglike canines, the inner minute and simple and growing close to and between the canines; lower jaw with canines at sides, 2 of them noticeably larger, and minute teeth among the larger ones; outer rays of each caudal lobe prolonged into filaments; dorsal rays VI–25, anal rays 25, pectoral rays 21 (Japan) ---------- Vireosa

1*b*. Chin without barbels.

  2*a*. Top of head compressed into a scaly keel or crest; body covered with minute deciduous ctenoid scales; teeth in both jaws in several rows, the outer row with larger teeth; upper jaw with 4 canine teeth anteriorly, outer row with larger teeth; upper jaw with 4 canine teeth anteriorly, and pointed; dorsal rays VI–32, anal rays 32, pectoral rays 20 or 21 (Sea of Timor) ---------- Oxymetopon

  2*b*. Top of head not compressed into a keel or crest.

    3*a*. Minute ctenoid scales regularly covering entire body and predorsal region to eyes; fine canine teeth in both jaws and 4 fanglike teeth in middle; caudal fin obtusely rounded, none of the caudal rays produced into filaments; dorsal rays VI–29, anal rays 30, pectoral rays 18 (Singapore) ---------- Orthostomus

    3*b*. Extremely minute embedded cycloid scales covering body to anterior part of first dorsal fin; no predorsal scales; teeth in several rows, those in anterior row in lower jaw enlarged; a median ray in each caudal lobe produced into a filament; dorsal rays VI–16, anal rays 15, pectoral rays 16 (Thailand) ---------- Herreolus

HERREOLUS FORMOSUS (H. M. Smith)

Herrea formosa Smith, 1931a, p. 40 (Koh Chula).

This is a minute, apparently rare, species, first made known from a specimen 2.3 cm. long taken in a tide pool on Koh Chula, off the Chantabun Estuary in Southeastern Thailand in 1930, and subsequently found in a tide pool on Koh Samet, Southeastern region, where four specimens 2.4 to 3 cm. long were caught in 1931.

Notwithstanding its very small size, this goby is rendered conspicuous by its coloration: Head and body pale olive-yellow; a broad black lateral band from mouth, through lower half of eye to base of caudal fin and thence in the lower part of that fin to its extremity; a black median dorsal band from tip of snout to base of caudal fin and thence spreading out on the upper caudal rays; all fins pale yellow.

Owing to the apparent loss of the type (U.S.N.M. No. 90324), never received in the U. S. National Museum, it is proposed to designate as a neotype one of the later specimens (U.S.N.M. No. 119611) and to make neoparatypes of the other three specimens now in hand (U.S.N.M. No. 119612).

It is a matter of considerable interest to note that Herre (1940) has found this fish in the Philippines, and collected 11 specimens 12 to 31 mm. long in Negros and Basilan in 1936–37. At Port Holland, Basilan, "a school of these fish lived in the growth on the piling of the wharf, whence they would emerge and swim about freely on the surface of the water, which is deep enough for ships to lie alongside the dock. At the slightest alarm they would dart back into the protection of the growth on the piling, so that it was very difficult to get at them." Some of the Port Holland fish had an increased number of branched rays in the dorsal (13 to 16) and anal (12 to 15) fins, but were otherwise in full agreement with the original description calling for 12 such rays. Herre's excellent halftone plate, the first representation of this species, shows only five spines in the first dorsal fin, but the description of the material indicates six spines.

Genus ELEOTRIS Bloch

Eleotris Bloch, *in* Schneider, Systema Ichthyologiae, p. 65, 1801. (Type, *Gobius pisonis* Gmelin).

ELEOTRIS FUSCUS (Bloch)

Poecilia fusca Bloch, *in* Schneider, 1801, p. 453 ("Oriadeae insulae rivulis").
Eleotris fusca Fowler, 1934a, p. 155 (Bangkok); 1935a, p. 160 (Bangkok); 1937, p. 248 (Tachin).

This species, of very wide distribution in both fresh and salt waters of the Orient (east coast of Africa, India, Ceylon, Malaya, Dutch East

Indies, Philippines, and other localities), has been reported by Fowler for Bangkok and Tachin from a number of specimens 6.6 to 15.6 cm. long. This fish is of a very retiring habit, and lies quietly on the bottom when not in search of food.

A length of 25 cm. is reported from other waters.

Genus **BOSTRICHTHYS** Duméril

Bostrichthys Duméril, Zool. Anal., p. 120, 1806. (Type, *Bostrychus sinensis* Lacepède.)

BOSTRICHTHYS SINENSIS (Lacepède)

Bostrychus sinensis Lacepède, 1802, vol. 3, p. 141, pl. 14, fig. 2 (China).
Bostrichthys sinensis Suvatti, 1936, p. 149 (upper Bangpakong River).

This is an extremely widespread species in the Pacific and Indian Oceans. On the mainland of Asia it ranges from China to Malaya. In Thailand it has not been often reported or recognized, and the only definite records are for the lower Menam Chao Phya in the Bangkok district and the upper Menam Bangpakong.

A length of about 16 cm. is attained in local waters.

The fish may be recognized by its brown body color marbled or streaked with darker brown, its large black white-edged caudal ocellus, its very small scales (up to 140 in longitudinal series), and its fine teeth in a band in each jaw and in a semioval patch on the vomer.

Genus **BUTIS** Bleeker

Butis Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 304, 1874. (Type, *Butis butis* (Bleeker) = *Cheilodipterus butis* Hamilton.)

BUTIS BUTIS (Hamilton)

Cheilodipterus butis Hamilton, 1822, pp. 57, 367 (Calcutta).
Butis melanostigma Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).
Eleotris butis Sauvage, 1883b, p. 151 (Menam Chao Phya).
Butis butis Hora, 1923b, p. 179 (Nontaburi, Bangkok).—Fowler, 1934a, p. 157 (Bangkok); 1935a, p. 160 (Bangkok, Paknam, Keng Sok); 1937, p. 248 (Bangkok, Tachin); 1939, p. 53 (Krabi).

From the Indo-Australian Archipelago and the Philippines, this species ranges to Malaya, Thailand, and India, in salt, brackish, and fresh water. In Thailand it has been found along the shores of the Gulf of Siam from Patani to Chantabun, often pushing its way into streams but never going very far from their mouth. Nontaburi on the Menam Chao Phya is about as far inland as the fish has been detected. Other rivers in which it has been collected are the Tapi near Bandon and the lower Bangpakong.

The species is small. The largest examples observed locally have been 11.5 cm. long.

A vernacular name, apparently applied to no other species, is *pla bu klet kheng* (hard-scale goby).

Genus PRIONOBUTIS Bleeker

Prionobutis Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 305, 1874. (Type, *Eleotris dasyrhynchus* Günther.)

PRIONOBUTIS KOILOMATODON (Bleeker)

Eleotris koilomatodon Bleeker, 1849 (15), p. 21 (Surabaya and Kammal).
Prionobutis koilomatodon Fowler, 1937, p. 248, fig. 259 (Paknam, Tachin).

This fish, ranging from India through the Indo-Australian Archipelago to the Philippines and China, is almost exclusively a salt-water form, but may be noticed here because of its reported occurrence in the lower Menam Chao Phya and lower Tachin Rivers. A specimen 3.3 cm. long was collected by Layang Gaddi November 27, 1929, near Pak Jong, in headwaters of the Menam Mun in Eastern Thailand, and another specimen 2.6 cm. long was taken by the writer March 17, 1930, on Koh Chula, a rocky islet off the Chantabun Estuary in Southeastern Thailand; and in both of these specimens the supraorbital ridge is very strongly serrated. Herre (1927, p. 52) found the fish several kilometers up the Pasig River near Manila.

A length somewhat over 10 cm. is attained.

Genus OPHIOCARA Gill

Ophiocara Gill, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 270, 1864. (Type, *Eleotris ophiocephalus* Cuvier and Valenciennes.)

OPHIOCARA POROCEPHALA (Cuvier and Valenciennes)

Eleotris porocephala Cuvier and Valenciennes, 1837, vol. 12, p. 237 (Seychelles; New Ireland).
Ophiocara porocephala Smith, 1934b, p. 325 (Chantabun Estuary, Paknam Wain, Koh Chang, Patani, Singora).

This species has a wide distribution in the Indian and Pacific Oceans. Thailand is well within its range and has yielded many specimens from both fresh and salt waters, although there are few published records of its occurrence. In addition to the localities in Southeastern and Peninsular Thailand, noted above, specimens were taken in October 1927 in the Patani River at Yamoo by Masya and Suvatti, of the Siamese Bureau of Fisheries.

The maximum size recorded for local specimens is 21 cm. for a fish from the Paknam Wain River May 21, 1934.

The fishermen apply to the fish several distinctive names. On the Paknam Wain River, in Southeastern Thailand, the name *pla chon nam kem* (salt-water serpent-head fish) is apt, as the fish bears a strong superficial resemblance to an *Ophicephalus*. In the Chantabun section of Southeastern region, a vernacular name *pla makua* has reference to a local fruit (guava) with somewhat the same shape. At Yamoo in Patani Province a name reported is *pla bu hua man* (fathead goby).

In his paper on fishes of the Tale Sap, Hora doubtfully records as *Ophiocara amboiensis* (Bleeker) a fish only 17 mm. long.

Genus OXYELEOTRIS Bleeker

Oxyeleotris BLEEKER (453), Arch. Néerl. Sci. Nat., vol. 9, p. 302, 1874. (Type, *Eleotris marmorata* Bleeker.)

The genus *Oxyeleotris*, established by Bleeker in 1874, with *O. marmoratus* as the type, is represented in the Thailand fauna by three fresh-water species as follows:

1*a*. A large black light-edged ocellus at upper base of caudal fin.
- 2*a*. Scales in longitudinal series 70 to 75; predorsal scales about 30; no barbel on upper jaw; snout scaly; general color dark green---- urophthalmus
- 2*b*. Scales in longitudinal series 90; predorsal scales 40; a short barbel on upper jaw; snout unscaled; general color brown, whitish below; 2 oblique dark stripes radiating from eye on cheek------------ siamensis

1*b*. No ocellus at base of caudal fin; scales in longitudinal series 70 to 90; general color yellowish, marbled with brown in large pattern; brown stripes along rows of scales---------------------------------- marmoratus

OXYELEOTRIS UROPHTHALMUS (Bleeker)

Eleotris urophthalmus BLEEKER, 1851 (45), p. 202 (Bandjermassing, Borneo); 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).—SAUVAGE, 1883b, p. 151 (Menam Chao Phya).

Described from fresh water in rivers at Bandjermassing, Borneo, and later recorded from rivers of New Guinea, this species was reported from Thailand by Bleeker in 1865. The only other reference to the fish in Thailand waters is that by Sauvage (1883b), who lists it as being represented in a collection made in the Menam Chao Phya by Dr. Harmand. The species has not been recognized in Thailand in recent years.

The two specimens on which Bleeker based the species in 1851 were 11 and 14 cm. long.

This fish resembles *O. siamensis* in having a black light-edged ocellus at the upper base of the caudal fin. The apparent differences as brought out in the description by Bleeker are the fewer scales in the longitudinal series, scaly snout, absence of a small barbel on each side of the upper jaw.

OXYELEOTRIS SIAMENSIS (Günther)

Eleotris siamensis Günther, 1861, vol. 3, p. 129 (Siam); 1864, p. 174 (Siam and Cambodia).—Bleeker, 1865 (356), p. 174 (Siam).

Oxyeleotris siamensis Hora, 1923b, p. 179 (Bangkok, Nontaburi).—Smith, 1930, p. 58 (Siam).

The fish has its center of distribution in the lower Menam Chao Phya, and in recent years is represented by many specimens from the Bangkok region. It has been reported as far north as Nontaburi, and thence to Paknam. Another stream where the fish has been found to abound is the Tapi River near Bandon, whence numerous living specimens were received in Bangkok by the Bureau of Fisheries.

A maximum length of 17 to 20 cm. is shown by the specimens examined. A female 16 cm. long, from a canal in Tonburi, Bangkok, in June had well-developed ovaries and would have spawned in a few weeks. A fish kept in a glass jar for nearly a month remained motionless on the bottom without even a fin moving. The habit in a wild state is to lie partly buried in soft mud in shallow water, and it is then easily possible to catch the fish by hand.

The fish resembles *Bostrichthys sinensis* (Lacepède) and may easily be mistaken therefor on superficial view. It may be recognized by its dark-brown or smoky-blue general color, dark radiating lines behind the eyes, black ocellus at upper base of the caudal fin, and very small scales, 90 in longitudinal series.

OXYELEOTRIS MARMORATUS (Bleeker)

Eleotris marmorata Bleeker, 1852 (55), p. 424 (Bandjermassing, Borneo).—Günther, 1861, vol. 3, p. 123 (rivers of Siam).—Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).—Sauvage, 1883b, p. 151 (Menam Chao Phya).

Oxyeleotris marmorata Hora, 1923b, p. 179 (Bangkok, Nontaburi).—Fowler, 1935a, p. 160 (*Callieleotris platycephalus* noted as a synonym) (Bangkok); 1937, p. 248 (Bangkok).

Oxyeleotris marmoratus Smith, 1930, p. 58 (Siam).

Callieleotris platycephalus Fowler, 1934a, p. 156, figs. 123, 124 (Bangkok).

The range of this species covers Borneo, Sumatra, Malaya, and Thailand. Locally it occurs throughout the Menam Chao Phya as far north as Paknampo, in Bung Borapet, in the Menam Lopburi, in the Menam Tachin (at Phra Pathom), and in the Peninsula, where there is a record of a specimen taken in the Tale Noi.

This is not only the largest of the local gobies, but it is also one of the largest in the world. Examples 30 to 40 cm. long are not infrequently met with, and a maximum length of 50 cm. is reported.

In the Thai vernacular this fish is called *pla bu* and *pla bu sai* (sand goby).

Genus VALENCIENNEA Bleeker

Valenciennea Bleeker (390), Versl. Meded. Akad. Wet. Amsterdam, vol. 2, p. 275, 1868. (Type, *Eleotris hasselti* Bleeker.)

VALENCIENNEA MURALIS (Cuvier and Valenciennes)

Eleotris muralis Cuvier and Valenciennes, 1837, vol. 12, p. 253, pl. 357 (Tukopia).

Thailand is included in the very wide range of this goby, which extends from India to Australia, East Indies, Philippines, and some of the islands of the Fiji and Samoan groups. In local waters the fish has not been found to be common, and the few local records are from Southeastern Thailand. Two specimens, 5.6 and 5.7 cm., were taken by the writer in March 1930 in a tide pool in the Chantabun Estuary, and one specimen of 6.4 cm. was obtained by H. G. Deignan in May 1937 in a tide pool on Koh Chang.

Genus PTERELEOTRIS Gill

Ptereleotris Gill, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 271, 1864. (Type, *Eleotris microlcpis* Bleeker.)

Among the eleotrid gobies this genus stands out prominently because of very numerous rays in the anal and second dorsal fins, the rays being described as undivided; the body covered with minute cycloid scales (150 or more in longitudinal series), with the head scaleless; one or two pairs of postsymphyseal canine teeth in the lower jaw; and caudal fin either truncate or emarginate.

The genus was named by Gill in 1863, with *Elcotris microlepis* Bleeker designated as the type. In the first description of the genus, given by Bleeker in 1874 (453), an important feature is the nondivided condition of the anal and second dorsal soft rays. Herre (1927, p. 83) reaffirms this peculiarity of the genus but in his figure of a new species (*dispersus*) from the Philippines he shows all those rays fully divided.

Two species are ascribed to Thailand:

1*a*. Second dorsal and anal rays 26 to 29; an oblique black stripe at base of lower pectoral rays; no black spot on base of caudal fin____________microlepis

1*b*. Second dorsal and anal rays 19 or 20; no black stripe at base of pectoral rays; a roundish jet black spot on base of median caudal rays______stigmaturus

PTERELEOTRIS MICROLEPIS (Bleeker)

Eleotris microlepis Bleeker, 1856 (149), p. 102 (Banda).

Originally described from the East Indies, this species was subsequently reported from east Africa (Playfair, 1866, p. 75, pl. 9, fig. 5) and is herein noted from Thailand. On March 10, 1926, on an exposed tide flat on the island of Pipidon, off the west coast of Thailand in the Bay of Bengal, the writer found several specimens under a stone in company with a holuthurian and ophiurans.

A length of 12 cm. is recorded for the species, but the Thailand specimens were less than half that size.

The oblique black stripe across the lower base of the pectoral fin is a characteristic feature of the fish.

PTERELEOTRIS STIGMATURUS, new species

FIGURE 102

Description.—Elongate, slender; body and head rather strongly compressed, dorsal profile from head to caudal fin nearly horizontal, ventral profile slightly decurved; depth 5.2 in standard length; least depth of caudal peduncle 0.5 depth of body; head 4.2 in standard length, its width contained 2.5 times in its length; mouth very oblique, lower jaw projecting, maxillary extending to a point under anterior margin of eye; teeth pluriserial, small, a pair of canines behind symphysis of lower jaw; snout short, less than eye and about equal to interorbital space; branchial openings separated by a broad isthmus.

Squamation: Head scaleless; body covered with minute, embedded cycloid scales, about 100 or 115 more in longitudinal series.

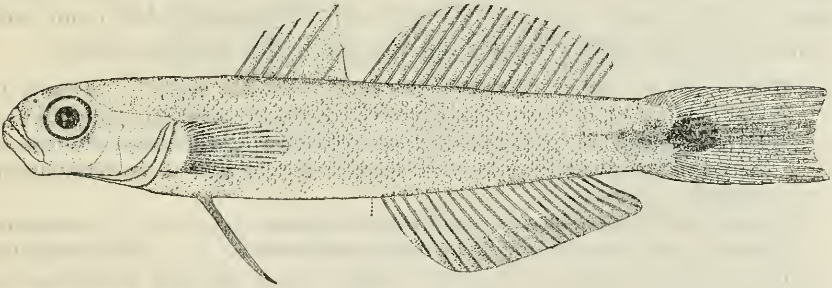


FIGURE 102.—*Ptereleotris stigmaturus*, new species: Type (U.S.N.M. No. 119639) Drawn by Mrs. Alice C. Mullen.

Fins: Dorsal fins well separated; first dorsal rays VI, the longest 0.6 length of head; rays in second dorsal 19 or 20, the longest equal to the longest in the first fin; caudal fin as long as head, its posterior edge slightly emarginate; anal fin similar to second dorsal, its origin slightly posterior to origin of latter, its rays 20; all rays of dorsal and anal fins unbranched; ventral fins with bases close together, the fins narrow, pointed, and 0.6 length of head; pectoral fins somewhat shorter than head and 1.5 times length of ventrals.

Coloration (in life): Generally milky white; a large jet-black spot on the base of the middle rays of the caudal fin; fins otherwise plain.

Type and paratypes.—The type (U.S.N.M. No. 119639), 2.6 cm. long, was taken in the estuary of the Chantabun River, Southeastern Thailand, April 5, 1930. Eight other specimens taken at the same time and place are paratypes, U.S.N.M. No. 119640.

Remarks.—This fish may be distinguished from the previously described species of *Ptereleotris* by the reduced number of rays (19 or 20) in the anal and second dorsal fins (which rays in species of the Indo-Australian Archipelago number 28 to 32 and in a Philippine species 25), by the conspicuous jet-black spot on the base of the caudal fin, and other characters. In *P. heteropterus* Bleeker from fresh water in Borneo, the median caudal rays are black throughout and the anal and second dorsal rays number 30 to 32.

Family GOBIIDAE: Gobies

As far as genera, species, and individuals are concerned, the great majority of gobies belong to this family. Most of the local species are small, and some of them exhibit much beauty of color, much shapeliness of body, and interesting habits and habitats. Some species are found as far inland as the headwaters of rivers in mountain streams, in which the ventral cup assists in maintaining their position; others inhabit the lower courses of the large rivers; a few live indifferently in either fresh or brackish water; and many are estuarine or coastal. The genera herein recognized number 25. Those most closely related are not always easily distinguishable from each other, hence the following key must be used with discrimination:

1*a*. General shape elliptical; body strongly compressed, the depth 2 to 3 times the width; dorsal fins contiguous or united basally; ventral fins short, united, forming a disk or tube; gill openings restricted to sides, opposite base of pectorals; teeth in several rows in each jaw, a pair of postsymphyseal canines in lower jaw.
  2*a*. Head and body scaleless, covered with thick skin________________ **Gobiodon**
  2*b*. Head naked, body covered with large ctenoid scales__________ **Paragobiodon**
1*b*. General shape moderately to very elongate; head and body compressed or depressed; head partly scaled to entirely naked; body scaled or naked; dorsal fins well separated; ventral fins wholly united and provided with a basal membrane, or united only at their base and the basal membrane more or less deficient; gill openings restricted to sides or extending more or less forward; teeth in one, several, or numerous rows in each jaw.
  3*a*. First dorsal fin with 5 spines.
    4*a*. Teeth in both jaws uniserial; head and anterior part of body scaleless, body covered with weak ctenoid scales behind first dorsal fin; second dorsal fin with 8 branched rays, anal fin with 11 branched rays. **Gobiopterus**
    4*b*. Teeth in both jaws pluriserial; head scaleless, body fully scaled; second dorsal and anal fins with 6 to 8 branched rays.
      5*a*. Very elongate; mouth small, maxillary not reaching vertical from anterior edge of eye; lower jaw with numerous short fleshy filaments; scales cycloid, about 39 in longitudal series______ **Pipidonia**
      5*b*. Moderately elongate, mouth exceedingly large, maxillary extending on preopercle; lower jaw with no fleshy filaments; scales ctenoid, about 29 in longitudal series____________________ **Eugnathogobius**

3*b*. First dorsal fin with 6 spines; teeth pluriserial in both jaws (uniserial in one jaw in *Oxyurichthys*); head naked or partly scaled; body fully scaled.

6*a*. Maxillary greatly produced backward, extending to, or nearly to, or onto the preopercle.

7*a*. Lower jaw and snout with short barbels________ Pogonogobius

7*b*. Lower jaw and snout without barbels; head depressed or compressed.

8*a*. Head depressed, scaled on opercle and to eyes; tongue truncate or emarginate.

9*a*. Branched dorsal and anal rays 6 or 7; caudal fin short, bluntly pointed; most anterior scale on top of head large, median, unpaired; gill openings wide, isthmus narrow; interorbital space narrow, less than eye__ Pseudogobiopsis

9*b*. Branched dorsal and anal rays 8; caudal fin short, rounded; no anterior median unpaired scale on top of head; gill openings restricted, isthmus narrow, interorbital space wide, twice eye___________________________ Gnathogobius

8*b*. Head strongly compressed, unscaled on top and on opercles; branched dorsal and anal rays 9 or 10; tongue rounded. Mahidolia

6*b*. Maxillary not greatly produced backward, extending to, under, or slightly behind eye.

10*a*. Teeth in upper jaw in one row, strong, caninoid; teeth in lower jaw in 2 to 4 rows, inner row may be enlarged; branched dorsal and anal rays 10 to 13; caudal fin long and pointed. Oxyurichthys

10*b*. Teeth in both jaws pluriserial.

11*a*. Upper pectoral rays free and silky; head depressed; top of head scaled backward from eyes; tongue bilobed. Bathygobius

11*b*. Upper pectoral rays not free and silky (except in some species of *Acentrogobius*).

12*a*. Scales ctenoid posteriorly, often becoming cycloid anteriorly, 24 to 50 in longitudinal series.

13*a*. Top, sides, and under parts of head with conspicuous ridges and flaps of skin; 48 to 50 scales in longitudinal series; predorsal scales extending over anterior part of opercles or nearly to eyes; opercles and preopercles with embedded scales; tongue rounded__ Macgregorella

13*b*. Head without ridges and flaps of skin.

14*a*. Scales on opercle, if any, cycloid.

15*a*. Scales on top of head extending to or between eyes.

16*a*. Foremost scale in median line on top of head large and unpaired; head compressed; opercles scaled or not; outer row of teeth in each jaw enlarged; outer row in lower jaw extending only half length of jaw, last teeth not strongly developed; a pair of postsymphyseal canines and some canines in inner row of lower jaw may be present; tongue rounded________________________ Stigmatogobius

16*b*. No enlarged unpaired scale in median line on top of head anteriorly.

17*a*. Head compressed or cylindrical.

18*a*. Opercle and preopercle more or less covered with large scales, scaled only on upper part, or scaleless; head compressed; gill openings restricted; scales on top of head not extending between eyes; some teeth enlarged.

19*a*. Scales in longitudinal series 25 to 45; teeth in outer and inner rows of both jaws enlarged and caninoid; teeth in outer row of lower jaw extending only half length of jaw, the last teeth recurved canines; tongue truncate to bilobate; branched dorsal and anal rays 6 to 12________ **Acentrogobius**

19*b*. Scales in longitudinal series 50 to 75; teeth in outer row of both jaws enlarged, those in outer row of lower jaw extending only half length of jaw, the last teeth recurved canines; tongue rounded or truncate; branched dorsal and anal rays 12 to 16. **Amblygobius**

18*b*. Opercle, preopercle, and cheek fully covered with large scales, which may be in regular horizontal rows separated by longitudinal grooves; scales in longitudinal series 24 to 32; outer row of teeth in each jaw enlarged, last teeth in outer row of lower jaw may be canine, or caninoid.

20*a*. Head compressed; interorbital space narrow, 0.5 diameter of eye or less; scales on top of head extending to eyes or very slightly into interorbital space; scales on cheek and preopercle forming an unbroken covering or divided by a horizontal groove_ **Gnatholepis**

20*b*. Head cylindrical; interorbital space wide, more than diameter of eye; scales on top of head extending on interorbital space nearly to line from anterior margin of eyes; scales on cheek and preopercle in about 6 horizontal bands divided by 4 horizontal grooves______________________ **Aulopareia**

18*c*. Opercle, preopercle, and cheek naked; scales on body ctenoid, confined to posterior part, and 22 to 30 in longitudinal series; teeth in upper jaw with outer row enlarged, in lower jaw with inner row enlarged, no canines. **Zonogobius**

17*b*. Head depressed.

21*a*. Opercle more or less covered with large scales, preopercle and cheek naked; scales in longitudinal series 23 to 40; no teeth noticeably enlarged; tongue truncate or slightly emarginate____________________________ **Vaimosa**

21*b*. Opercle and preopercle sometimes with a few large scales on upper part; scales in longitudinal series 25 to 40; outer and inner rows of teeth in each jaw enlarged, unequal, wide-set, outer row curved; gill openings wide; chin prominent; tongue bilobed____ Glossogobius

17*c*. Head globose; upper part of opercle, preopercle, and cheek with patches of small scales; scales in longitudinal series 29 to 40; teeth in 4 to 6 rows in front of each jaw, reduced to 2 or 3 rows at sides; outer row more or less enlarged; a pair of recurved canines laterally on lower jaw; tongue truncate; mouth small, maxillary usually not reaching vertical from anterior margin of eye______________________________ Creisson

15*b*. Scales on top of head not extending to eyes.

22*a*. Predorsal scales not extending beyond opercle; opercle and preopercle naked; scales in longitudinal series 38 to 42; teeth in upper jaw with outer row enlarged, in lower jaw with inner row enlarged, some teeth at symphysis of lower jaw and posteriorly may be canine or caninoid; tongue truncate or slightly emarginate; caudal fin bluntly or acutely pointed __________________________ Oligolepis

22*b*. Head nearly or entirely naked; sometimes a postorbital row of scales extending above opercle; scales in longitudinal series 25 to 45; teeth in outer row of each jaw enlarged, in outer row of lower jaw extending only half length of jaw, the last teeth caniniform; tongue broadly rounded, truncate, emarginate, or mucronate____ Ctenogobius

14*b*. Scales on opercle ctenoid, head otherwise naked; predorsal region naked, with a median groove; scales in longitudinal series about 25; outer row of teeth in each jaw enlarged, no canines; tongue truncate; gill openings restricted, isthmus broad_________ Brachygobius

12*b*. Scales cycloid, 75 to 140 in longitudinal series; head compressed; opercles and cheeks naked; tongue truncate; maxillary extending beyond eye; caudal fin obtusely to acutely pointed and longer than head; gill openings very wide___________________________________ Cryptocentrus

Genus GOBIODON Bleeker

Gobiodon Bleeker (151), Nat. Tijdschr. Nederl. Indië, vol. 11, p. 407, 1856. (Type, *Gobiodon heterospilos* Bleeker.)

The gobies of this genus are widely distributed in the Pacific and Indian Oceans and easily recognizable by their small size; ovate, compressed, scaleless body; large, deep head; small, oblique mouth; pluriserial teeth, with postsymphyseal canines in lower jaw; dorsal fins contiguous or partly united; short rounded caudal, and pectorals, and very small, cup-shaped ventrals. The color variations have given rise to many nominal species. Two local species are recorded, which may be differentiated as follows:

1*a*. Head deeper than long; profile in front of eyes subvertical; head and body green, with 5 irregular scarlet cross bands on head and about 5 scarlet longitudinal bands on body interspersed with scarlet spots on back; a black spot at upper end of gill opening; pectorals and ventrals uniform green; dorsal, caudal, and anal fins green at base, yellow distally; head and body may lack red bars, all fins may be plain green, and black spot at upper end of gill opening may be absent---------------------------------- **verticalis**

1*b*. Head about as long as deep; profile in front of eyes strongly arched but not subvertical; head and most of body red, back and caudal peduncle dark brown or reddish brown; head with about 6 narrow wavy cross lines of silvery blue, a straight silvery blue line from origin of first dorsal fin across pectoral base; all fins reddish brown; a pale line at bases of dorsal and anal fins-- **rivulatus**

GOBIODON VERTICALIS Alleyne and Macleay

Plate 8, *a*, *b*

Gobiodon verticalis Alleyne and Macleay, 1877, p. 333, pl. 12, fig. 4 (New Guinea).—Smith, 1933a, p. 83 (Gulf of Siam).

Originally described from New Guinea, this species is now known from Australia, Polynesia, and the Gulf of Siam.

Of four specimens, 2.5 to 4 cm. long, taken by the writer in coral heads at Koh Tao, the two largest, 3.5 and 4 cm. long, were uniformly green with red bands on head and body, while the two smallest, 2.5 and 2.8 cm. long, possibly females, were uniformly green without any red bands. Another lot, collected by Masya Chitrakarn and Boon Chuay Indrambarya among corals on Koh Kahten, comprised seven specimens, 3.5 to 4 cm. long, all of which showed red bands on head and body.

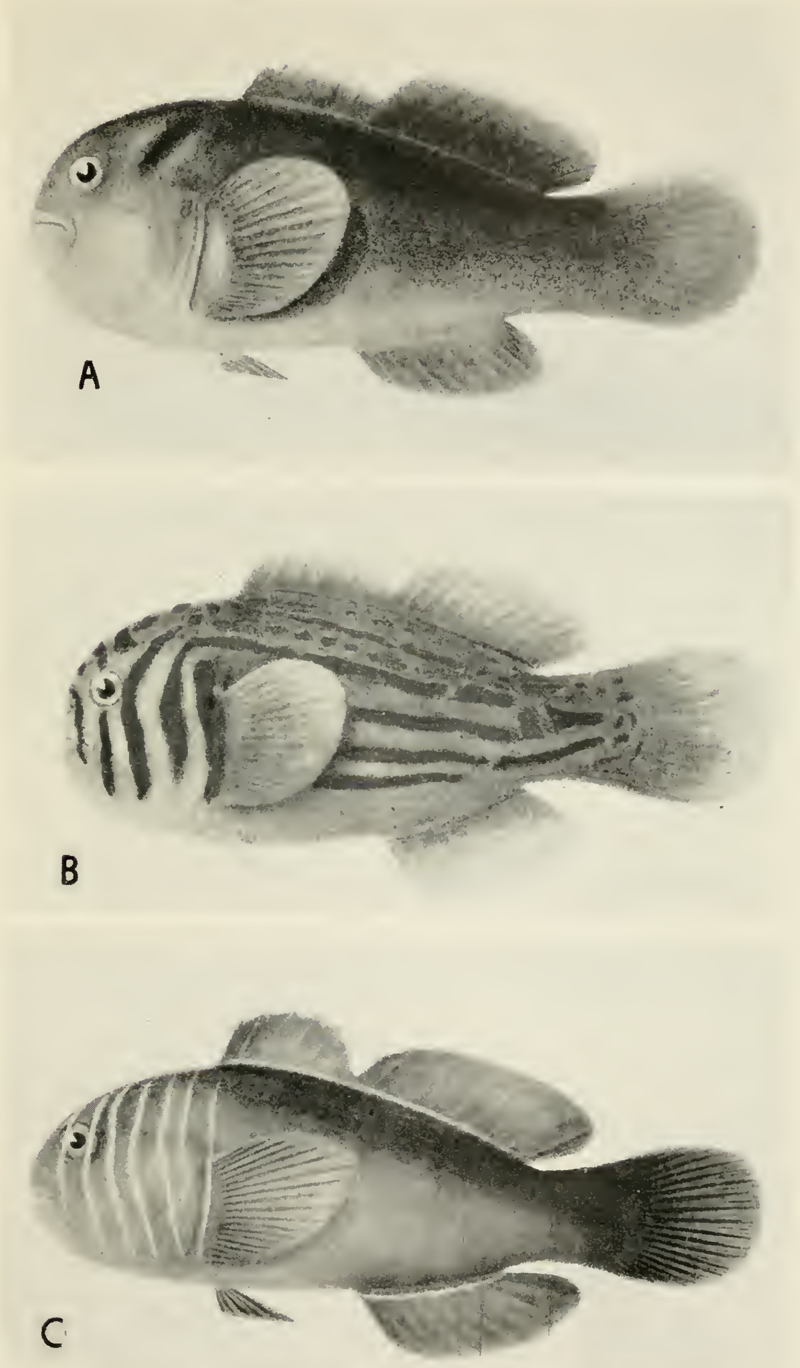
GOBIODON RIVULATUS (Rüppell)

Plate 8, *c*

Gobius rivulatus Rüppell, 1828, p. 138 (Jubal Island, Abyssinia).
Gobiodon rivulatus Smith, 1933a, p. 82 (Gulf of Siam).

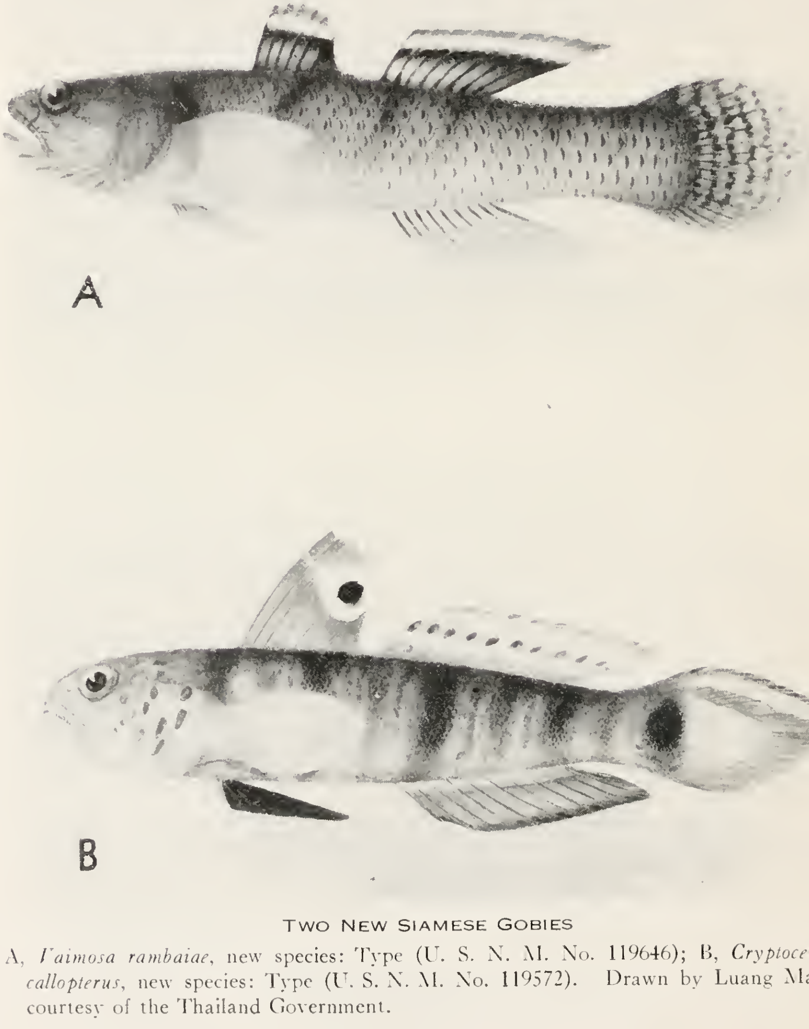
Ranging from the Red Sea and Madagascar to Australia, Polynesia, and China, this species was to be expected in Thailand waters. A lot of eight specimens was collected by the writer in coral heads at Koh Tao, Gulf of Siam. Two of these specimens were removed from a coral clump that had been snagged at a depth of 30 meters. One fish, placed in a bottle of sea water, adhered to the glass, head downward, by its small ventral fins serving as a sucking disk. Other specimens have been taken at Koh Kahten.

The maximum size represented by these specimens was 4 cm.



Two Species of Siamese Gobies

A, B, *Gobiodon verticalis* Alleyne and Macleay, showing two color phases; C, *Gobiodon rivulatus* (Rüppell). Drawn by Luang Masya; courtesy of the Thailand Government.



Two New Siamese Gobies

A, *Vaimosa rambaiae*, new species: Type (U. S. N. M. No. 119646); B, *Cryptocentrus callopterus*, new species: Type (U. S. N. M. No. 119572). Drawn by Luang Masya; courtesy of the Thailand Government.

Genus PARAGOBIODON Bleeker

Paragobiodon Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 309, 1874. (Type, *Gobius melanosoma* Bleeker=*Gobius gobiodon* Day?)

The genus *Paragobiodon* of Bleeker is readily distinguishable from *Gobiodon* of Bleeker by having the body fully covered with large ctenoid scales. These two genera, with *Pseudogobiodon* of Bleeker characterized by the absence of scales and the absence of post-symphyseal canine teeth, constitute the subfamily Gobiodontinae (phalanx Gobiodontini of Bleeker, 1874). The oblong-ovate body is compressed, the head is obtuse and scaleless, the teeth are pluriserial and simple, the mouth is small and curved, the gill openings are restricted to the side of the head, the dorsal fins are contiguous, with 6 spines in the first dorsal and 9 to 11 branched rays in the second dorsal, the caudal fin is rounded, and the anal has 9 or 10 branched rays.

PARAGOBIODON KERRI H. M. Smith

Paragobiodon kerri Smith, 1931a, p. 42, fig. 20 (Koh Tao).

This minute but very striking goby remains known only from the type, taken from a small coral head in shallow water on Koh Tao in 1928. The body in life was brownish red, darker on back, abdomen pale yellow, head pale crimson, and all the fins except the ventrals were uniformly jet-black, the ventrals being black at base and dusky distally.

Genus GOBIOPTERUS Bleeker

Gobiopterus Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 311, 1874. (Type, *Apocryptes brachypterus* Bleeker.)

The gobies referable to this genus are of very small size, and inhabit fresh and salt lakes, streams, and estuaries in eastern India, Thailand, Malaya, and some East Indian islands. Since Bleeker established the genus for the accommodation of a species (*brachypterus*) from Java, very few species have been recognized. The principal generic characters are: Transparent body; very oblique, nearly vertical mouth; wide-spaced uniserial conic teeth in both jaws, with a pair of post-symphyseal canines in the lower jaw; bilobate tongue; scaleless head; weak ctenoid scales covering all of the body or only the part posterior to the pectoral base; 5 spines in the first dorsal fin, 6 to 8 branched rays in the second dorsal, and 7 to 13 branched rays in the anal fin; ventral fins united into a long, narrow tube.

Gobiopterus is the only local genus referable to the subfamily Sicydiinae, as established by Gill in 1860. The action of Koumans (1931) in coining a new subfamily name, Sicydiaphiinae, based on the generic names *Sicydium* and *Aphia*, does not seem to have been desirable or sound. The International Rules of Zoological Nomenclature provide for the formation of a family or subfamily name from the stem name of its type genus, thus excluding the use of two or more generic names in forming a new family or subfamily name.

The local species comprise one common and well-known form and one whose status is doubtful but which may be identified tentatively with the Javan form. They may be distinguished by the following characters:

1*a*. Caudal fin truncate; body white, translucent, a few round black spots on side and abdomen and a row of minute black spots at base of anal fin--- chuno

1*b*. Caudal fin obtusely rounded; body greenish translucent; upper lip black; a faint black band on anal fin------------------------------- brachypterus

GOBIOPTERUS CHUNO (Hamilton)

FIGURE 103

Gobius chuno HAMILTON, 1822, pp. 53, 366 (below Calcutta).

Gobiella pellucida SMITH, 1931a, p. 33, fig. 16 (Bangkok).—FOWLER, 1937, p. 248 (Bangkok).

Gobiopterus chuno MUKERJI, 1936, p. 9, figs. 1, 2 (Bangkok, Tale Sap; Singapore; India).

Minute transparent gobies found in abundance in fresh water in Bangkok appeared to represent a new genus and new species and were described under the name *Gobiella pellucida*. It subsequently developed that *Gobiopterus* Bleeker (1874 [453] with the type (*brachypterus*) from Java, is an earlier name for the same kind of goby, and *Gobiella* became a synonym.

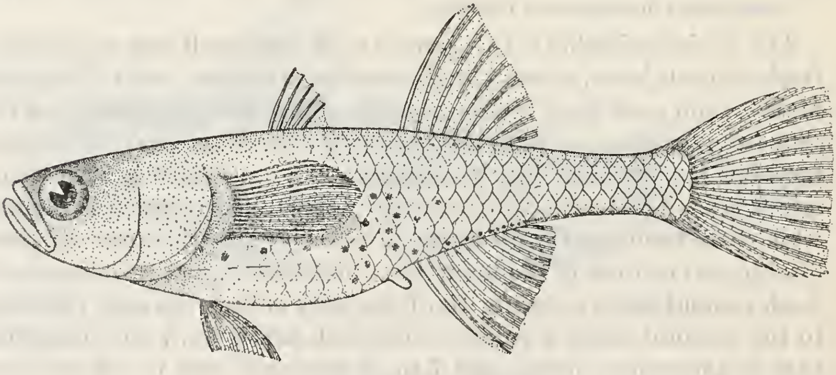


FIGURE 103.—*Gobiopterus chuno* (Hamilton). Drawn by Nai Chote Suvatti; courtesy of the Thailand Government.

Hamilton (1822), under the name *Gobius chuno*, described a fish that for over a hundred years seems to have been left in an uncertain status until Hora (1934), collecting in the type locality, the mouth of the Ganges, was able to reidentify the species and give it proper generic allocation. Hamilton's description was so defective in essential particulars that Günther (1861, vol. 3) and Day (1876–78) made no mention of the species. It remained for Mukerji (1936) to point out that *Gobiella pellucida* from Thailand, as well as *Gobiella birtwistlei* Herre (1934) from Singapore, is specifically the same as *Gobiopterus chuno.* Mukerji gave figures of the jaws and teeth and of the tongue based on specimens from Bangkok. These figures show a single row of wide-spaced conical teeth in each jaw, with a pair of postsymphyseal canines in the lower jaw, and a bilobed tongue.

There appears to be a numerical disproportion of the sexes, the females being more numerous in every lot collected, in the ratio of 2 or 4 to 1. Fully mature fish of both sexes range from 18 to 21 mm. in total length, with no difference in the average size of males and females. The transparent abdominal walls permit a clear view of the eggs.

GOBIOPTERUS BRACHYPTERUS (Bleeker)

Apocryptes brachypterus BLEEKER, 1855 (138), p. 401 (Java).
Micrapocryptes sp. HORA, 1924a, p. 495, fig. 7 (Tale Sap).

This species was first described as *Apocryptes brachypterus* by Bleeker and later made the type of his genus *Gobiopterus.* Hora (1924a) reporting on fishes collected in the Tale Sap by Dr. Annandale, found two specimens, 16.5 and 18 mm. long, which were referred to Hora's new Indian genus *Micrapocryptes*, which Hora later synonymized with *Gobiopterus.* The specimens could not be identified satisfactorily as to species but were thought by Hora to be closest to *Gobiopterus brachypterus* from Java. On the basis of the foregoing information, the assignment of this species to Thailand, while entirely plausible, must be regarded as tentative.

Genus PIPIDONIA H. M. Smith

Pipidonia H. M. SMITH, Proc. U. S. Nat. Mus., vol. 79, art. 7, p. 39, 1931. (Type, *Pipidonia quinquecincta* H. M. SMITH.)

PIPIDONIA QUINQUECINCTA H. M. Smith

Pipidonia quinquecincta SMITH, 1931a, p. 39, fig. 19 (Koh Pipidon).

This rare goby is known from a specimen, 2.6 cm. long, taken in a tide pool on the island of Pipidon lying a short distance off the west coast of Peninsular Thailand south of Puket. The type, assigned U.S.N.M. No. 90317, appears not to have been received; hence it is not possible to verify and amplify certain details of the original description. Especially desirable is the verification of the presence of five spines in the first dorsal fin, as represented in the drawing of a Thai artist and as independently determined by the writer.

Attention should be drawn to the goby called *Hetereleotris arenarius* by Snyder (1908, p. 100; 1912, p. 513, pl. 67, fig. 3), based on a few specimens from the islands of Kiushu and Okinawa, Japan. Although the genus *Heterleotris* belongs in the family Eleotridae, with ventral fins separated, Snyder's description specifies united ventral fins, which would make the fish one of the Gobiidae. The figure of *H. arenarius* is strongly suggestive of *Pipidonia*, in which genus the fish was placed by Tomiyama (Gobiidae of Japan, 1936), with a question as to whether *Pipidonia quinquecincta* may not be *Heterleotris arenarius*. The similarity is close but the differences in structure and coloration are sufficient to separate the two species.

Genus EUGNATHOGOBIUS H. M. Smith

Eugnathogobius H. M. Smith, Proc. U. S. Nat. Mus., vol. 79, art. 7, p. 37, 1931. (Type, *Eugnathogobius microps* H. M. Smith.)

EUGNATHOGOBIUS MICROPS H. M. Smith

Eugnathogobius microps Smith, 1931a, p. 37, fig. 18 (Bangpakong River).

Described from a specimen, 3.3 cm. long, from the lower Bangpakong River in Central Thailand, this species has been found in other parts of that river, including the upper reaches where the water is quite fresh. It has not been reported from other localities but should be expected in the lower Menam Chao Phya, the lower Tachin, and other rivers discharging into the head of the Gulf of Siam.

The fish may be recognized by its small size, very large oblique mouth, which extends nearly to the posterior margin of the preopercle, small eyes on the top of the head, and comparatively plain coloration, together with naked head, dorsal rays V–I, 7, anal rays I, 6, and conspicuous rows of pores on the top and sides of the head and along the ramus of the lower jaw.

During a number of years the fish was taken as far up the Bangpakong River as the town of Petrieu. The genotype, a male 3.3 cm. long, has the maxillary contained 1.4 times in the head and equal to the postorbital space. In a female 3.1 cm. long from Petrieu, the maxillary is 0.5 the length of the head. Paratypes in the U. S. National Museum bear the numbers 119591 and 119593.

Genus POGONOGOBIUS H. M. Smith

Pogonogobius H. M. Smith, Proc. U. S. Nat. Mus., vol. 79, art. 7, p. 37, 1931. (Type, *Gobius planifrons* Day.)

POGONOGOBIUS PLANIFRONS (Day)

Gobius planifrons Day, 1873, p. 108 (Bombay).

Pogonogobius planifrons Smith, 1931a, p. 37 (Menam Chao Phya at Paknam, Chantabun Estuary).—Fowler, 1935a, p. 161 (Paknam).

The genus *Pogonogobius* (Smith, 1931a) has a single known species, *P. planifrons* (Day) (1873), recorded from India and Thailand. The peculiar generic characters are the compressed body; greatly depressed head; large nearly horizontal mouth, with jaws reaching far beyond the eyes; small teeth in several rows in each jaw, none canine; about 8 fleshy barbels on each side of the snout, 1 large pair of barbels on the chin, and 1 pair on each side of the lower jaw under the anterior nostrils; body covered with ctenoid scales, about 46 in longitudinal series, opercles and cheeks naked; conspicuous rows of pores on opercles, cheeks, snout, and under side of lower jaw; dorsal rays VI–I, 9 or 10, anal rays I, 9 or 10.

Locally the fish is found in brackish and fresh water. It was first met with at Paknam on the Menam Chao Phya in June 1927, when two specimens, 6.5 and 7.5 cm. long, were taken. In 1935 Fowler reported one, 7.8 cm. long, from the same place. From the Chantabun Estuary in Southeastern Thailand three specimens 6.8 to 8.7 cm. long were collected in July 1928.

Day's type was 10 cm. long.

Genus PSEUDOGOBIOPSIS Koumans

Pseudogobiopsis KOUMANS, Zool. Meded., vol. 18, p. 131, 1935. (Type, *Gobiopsis oligactis* Bleeker.)

PSEUDOGOBIOPSIS OLIGACTIS (Bleeker)

Gobiopsis oligactis BLEEKER (461), Arch. Néerl. Sci. Nat., vol. 10, p. 113, 1875 (Amboyna).

Pseudogobiopsis oligactis KOUMANS, 1935, p. 131, fig. 4 (Bangpakong River, Amboyna, Indo-Australian Archipelago).—FOWLER, 1937, p. 251 (Bangkok).

The known range of this species is restricted. The type, and the only specimen referred to by Bleeker, was found by Koumans in the Royal Natural History Museum in Leiden, together with five additional specimens in the Bleeker collection, and one without indication of locality in the Zoological Museum in Amsterdam. The only other habitat is Thailand in two of the large rivers debouching into the head of the Gulf of Siam.

Excellent series of 25 specimens were taken by the writer in the Bangpakong River in June 1928 and 35 specimens in June 1933, and 12 specimens were reported by Fowler (1937) as coming from the Menam Chao Phya at Bangkok. Two of the specimens from the Bangpakong, sent to Dr. Koumans in 1934, were used by him in defining the genus *Pseudogobiopsis*.

The type was 2.6 cm. long. Other Bleekerian specimens were up to 5.3 cm. The largest Thailand examples are 4.5 cm.

In his description of *Pseudogobiopsis oligactis*, Koumans (1935) stated that the maxillary extends to the posterior margin of the opercle. In his 1931 paper, p. 66, he described the genus *Gobiopsis*, which then included *oligactis*, as having the maxillary "prolonged posteriorly to the posterior margin of preoperculum." Koumans' figure, together with the specimens now in hand, shows that the long maxillary reaches no farther backward than the anterior margin of the preopercle.

GNATHOGOBIUS, new genus

Genotype.—Gnathogobius aliceae, new species.

Moderately elongate; body compressed; head broad, depressed, flat; interorbital space wide; mouth large, maxillary produced backward nearly or quite to opercle; tongue truncate; in upper jaw an outer row of small teeth and a row of very fine teeth behind, in lower jaw a pluriserial patch of small teeth anteriorly, with some of the lateral teeth enlarged but none canine or caninoid; gill openings restricted to sides, isthmus broad; body covered with weakly ctenoid scales becoming cycloid anteriorly; region in front of dorsal fin fully scaled to eyes; opercle, base of pectoral fin, and breast scaled; conspicuous lines of papillae on cheek and opercles; dorsal rays VI–I, 7; anal rays I, 7; caudal fin short, rounded; pectoral fin without free rays.

This genus represents one of a group of Oriental gobies of the family Gobiidae characterized by a marked development of the jaws, with the maxillary extending on the preopercle or even to the opercle. Other genera in the group are *Waitea* (Jordan and Seale, 1906), *Eugnathogobius* (H. M. Smith, 1931), *Mahidolia* (H. M. Smith, 1932), and *Pseudogobiopsis* (Koumans, 1935). The relations of these genera to one another are shown in the following synopsis, in which *Waitea*, a non-Thailand genus, is included because it has become involved with *Mahidolia:*

1*a*. First dorsal fin with 5 spines; branched dorsal rays 7, branched anal rays 6; caudal fin rounded, shorter than head; head depressed; interorbital space 2 times eye; eyes very small; gill openings restricted; isthmus broad; head scaleless -- Eugnathogobius

1*b*. First dorsal fin with 6 spines; eyes of moderate size.

  2*a*. Scales on top of head extending to eyes; scales on opercle; head depressed.

    3*a*. Most anterior scale on top of head large, median, unpaired; gill openings wide, continued well forward; isthmus narrow; interorbital space narrow, less than eye; branched dorsal rays 6 or 7, branched anal rays 6; caudal fin short, bluntly pointed---------------- Pseudogobiopsis

    3*b*. No median unpaired scale on top of head; gill openings restricted, not continued well forward; isthmus broad; interorbital space twice as wide as eye; branched dorsal rays 8, branched anal rays 8; caudal fin short, rounded-- Gnathogobius

  2*b*. A few small scales in front of dorsal fin, but none extending to eyes; no scales on opercle; head compressed; gill openings wide, extending well forward; isthmus narrow; interorbital space less than half eye; branched dorsal rays 10, branched anal rays 9; caudal fin short, rounded. Mahidolia

  2*c*. No scales on top of head or on opercle; head compressed; gill openings restricted; isthmus broad; interorbital space less than half eye; branched dorsal rays 10, branched anal rays 12; caudal fin long, lanceolate-- Waitea

GNATHOGOBIUS ALICEAE, new species

FIGURE 104

Description.—Body moderately compressed; depth about 5 in standard length; least depth of caudal peduncle 1.9 in its length and 2.4 in head; head depressed, broad, flattened on top, 3.2 in standard length, its width 0.75 its length; mouth large, horizontal, maxillary 1.2 in head, extending to posterior margin of preopercle; snout broad, evenly rounded, 4 in head; eyes well separated, 5 in head, 1.8 in the flat interorbital space; teeth as in the generic description; tongue thin, with rounded tip; gill openings narrow, corresponding with base of pectoral fins.

Squamation: Body fully covered with weakly ctenoid scales becoming cycloid anteriorly, the scales extending on predorsal region to eyes, on breast, and on base of pectorals; thin cycloid scales on opercle; scales in longitudinal series 35 or 36, in transverse series between origins of second dorsal and anal fins 11, in predorsal area 17, and around caudal peduncle 12; cheek and opercle with prominent lines of papillae.

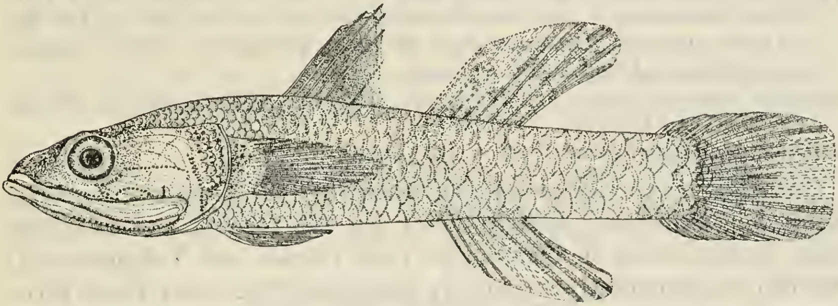


FIGURE 104.—*Gnathogobius aliceae*, new species: Type (U.S.N.M. No. 119604). Drawn by Mrs. Alice C. Mullen.

Fins: Dorsal rays VI–I, 7, all of moderate length; caudal fin rounded, shorter than head; anal rays I, 7, similar to second dorsal; ventrals not reaching anal opening, 1.8 in head, basal membrane weak; pectorals 0.6 length of head, pectoral rays 17 in both fins.

Coloration: Pale yellow, scales of back and top of head dull brown, each scale of sides with a yellowish brown edge; opercle and base of pectorals with small round black spots; first dorsal blackish, with a narrow white edge; second dorsal with reddish brown spots on rays and membranes forming irregular transverse rows; other fins plain.

Type and paratype.—The type (U.S.N.M. No. 119604), a male 4.7 cm. long, was taken in Bangkok on May 2, 1931. A paratype (U.S.N.M. No. 119605), a female 3.9 cm. long, was obtained at the same place and date.

Remarks.—The little fish is not rare in a certain area of a canal in the city of Bangkok but has not been taken elsewhere, probably because it was not sought in suitable places. The specimens in hand were found in association with a goby of similar size, a new species of *Vaimosa* described on p. 538, and were kept in good condition in a small aquarium at the Siamese Bureau of Fisheries for a period of 7 months, fed on mosquito larvae and entomostracans.

This species may be recognized at once by its broad, depressed head and broad, rounded snout, combined with the greatly extended maxillary, which may reach to the opercle.

Named for the writer's daughter, Alice Hanford Cowdry.

Genus MAHIDOLIA H. M. Smith

Mahidolia H. M. Smith, Journ. Siam Soc., Nat. Hist. Suppl., vol. 8, p. 255, 1932. (Type, *Mahidolia normani* Smith and Koumans.)

MAHIDOLIA MYSTACINA (Cuvier and Valenciennes)

Gobius mystacinus Cuvier and Valenciennes, 1837, vol. 12, p. 124 (Java).

Waitea mystacina Jordan and Seale, 1906, p. 407, fig. 94 (Samoa, Java) (not *Gobius mystacinus* Cuvier and Valenciennes).—Koumans, 1935, p. 133, fig. 2 (Java, Amboyna, Siam, east coast of Africa, Philippines) (*Gobius mystacinus* Cuvier and Valenciennes in part).

Mahidolia normani Smith and Koumans, *in* Smith, 1932a, p. 256, pl. 23, fig. 1 (Chantabun Estuary).

Mahidolia mystacina Smith, 1941b, p. 413 (Siam).

Described by Cuvier and Valenciennes in 1837 from a specimen 2 inches long sent from Java by Kuhl and van Hasselt and called by them *pulverulentus* in manuscript (*fide* Cuvier and Valenciennes), this fish was apparently completely lost sight of for many years, turning up in Southeastern Thailand in 1926. It is common in the estuary of the Chantabun River, and specimens were taken on various occasions in 1926 and 1931.

A maximum length of 6.5 cm. is attained by the fishes examined.

A peculiar feature is disclosed by a specimen, 6.4 cm. long, as taken from a fine-mesh bag net in the Chantabun Estuary in June 1931. An anchovy (*Stolephorus*) 3.2 cm. long had its head in the anterior part of the goby's mouth and the posterior part of its body and caudal fin projecting from the left branchial opening, having evidently reached this position during the struggles of the goby among the congested small fish contents of the net. The violent gasping efforts of the goby also resulted in the turning of each projecting maxillary into the mouth.

An examination by Dr. Koumans in 1934 of the type specimen of *Gobius mystacinus* in the Paris Museum disclosed agreement of that species with the Thai form described by Smith and Koumans (in Smith, 1932) under the name *Mahidolia normani*, but the contention of

Koumans (1935) that *Waitea mystacina* of Jordan and Seale (1906) from Samoa is the same species cannot be accepted. As has been shown elsewhere (Smith, 1941b), the genus *Waitea* of Jordan and Seale is to be regarded as distinct from *Mahidolia*, and the species called *Waitea mystacina* has been given another name.

The two gobies, 45 and 46 mm. long, described by Herre (1927, p. 208) from Panay under the name *Waitea mystacina* are believed to be referable to the present species, whose range is therefore now known to include Java, Thailand, and the Philippines.

Genus OXYURICHTHYS Bleeker

Oxyurichthys Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 324, 1874. (Type, *Oxyurichthys belosso* Bleeker.)

OXYURICHTHYS MICROLEPIS (Bleeker)

Gobius microlepis Bleeker, 1849 (15), p. 35 (Surabaya and Sumanap).
Oxyurichthys sp. (near *microlepis*) Hora, 1924a, p. 495 (Tale Sap).

Known from Penang, Java, Madura, the China Sea, and the Philippines, this very beautiful goby has been found to be common in the Chantabun Estuary in Southeastern Thailand but does not appear to have been detected elsewhere in that country with the possible exception of three young specimens collected by Dr. Annandale in the Tale Sap and identified by Hora as probably representing the present species.

Collections in the Chantabun Estuary have included two in June 1926, 10.2 and 10.5 cm. long; one in May 1927, 9.5 cm. long; one in July 1928; two in June 1931, 9.2 and 9.5 cm. long; and one in April 1933, 8.8 cm. long.

Genus BATHYGOBIUS Bleeker

Bathygobius Bleeker (491), Arch. Néerl. Sci. Nat., vol. 13, p. 54, 1878. (Type, *Gobius nebulopunctatus* Cuvier and Valenciennes.)

BATHYGOBIUS FUSCUS (Rüppell)

Gobius fuscus Rüppell, 1828, p. 137 (Red Sea).
Bathygobius fuscus Fowler, 1937, p. 250 (Paknam, Rayong).

This fish has the distinction of being perhaps the most widely distributed of all Pacific gobies, known from Africa and India to the East Indies, Hawaii, Samoa, and elsewhere in the South Pacific Ocean. The contention that the species occurs in the Atlantic (Koumans, 1935) is not confirmed, although the genus is represented there by the species *soporator*.

On the coasts of Thailand the fish is common, and exhibits the great variation in coloration that has been noted in other places. It shows a tendency to push its way up streams, and is known from the Chantabun Estuary and the lower Menam Chao Phya. It is, however, primarily a salt-water form.

It reaches a length of 9 cm. but averages smaller.

Genus MACGREGORELLA Seale

Macgregorella SEALE, Philippine Journ. Sci., ser. A, gen. sci., vol. 4, p. 533, 1909. (Type, *Macgregorella moroana* Seale.)

The suggestion of Koumans (1931, p. 76) that the genus *Macgregorella* may be synonymous with *Callogobius* (Bleeker, 1874) cannot be accepted. The latter genus, which as far as the ventral fins are concerned is near the border line of the eleotrids, has the basal membrane very weakly or not at all developed, which is not true of *Macgregorella.*

MACGREGORELLA MOROANA Seale

Macgregorella moroana SEALE, 1909, p. 533 (Jolo, Jolo Island, Philippine Islands); SMITH, 1933a, p. 81 (Chantabun Estuary).

Known otherwise only from the Philippines, this species has been detected in Southeastern Thailand, where two specimens 3.8 and 4.8 cm. long were collected in 1931. Differences from the type specimens as described by Seale are in the extension of the predorsal scales nearly to the eyes and in the presence of imbedded and scarcely visible scales on opercles and preopercles (as pointed out by Herre), and in the presence of ctenoid scales on the caudal peduncle, the scales otherwise being cycloid.

Genus STIGMATOGOBIUS Bleeker

Stigmatogobius BLEEKER (453), Arch. Néerl. Sci. Nat., vol. 9, p. 323, 1874. (Type, *Gobius pleurostigma* Bleeker.)

The genus *Stigmatogobius* of Bleeker (1874) is very close to *Vaimosa.* The genotype is *Gobius pleurostigma* Bleeker, from the fresh waters of Java, which is regarded as a synonym of *sadanundio.* The teeth in both jaws are in several rows, although in the original description of the genus the teeth in the upper jaw were erroneously stated to be uniserial. The anterior margin of the tongue is rounded. The scales on the back extend to or between the eyes, and the most anterior scale is enlarged and unpaired; the opercle is scaled.

STIGMATOGOBIUS SADANUNDIO (Hamilton)

Gobius sadanundio HAMILTON, 1822, pp. 52, 366 (near Calcutta).
Gobius apogonius KÁROLI, 1882, p. 164 (Bangkok).
Vaimosa spilopleura SMITH, 1933a, p. 66, pl. 2, fig. 2 (Chantabun River, Chao Phya, Bangpakong, and Tachin Rivers).—HERRE and MYERS, 1937, p. 41 (Negri Sembilan, Malaya).—FOWLER, 1937, p. 252, fig. 279 (Tachin).
Stigmatogobius sadanundio FOWLER, 1935a, p. 161 (Bangkok).

If the fish from Thailand and the Malay States that has been called *Vaimosa spilopleura* is identifiable with the fish imperfectly described by Hamilton (1822) as *Gobius sadanundio* from the estuaries of the Ganges near Calcutta, as seems highly probably, this species has a range extending from India and Burma to the Indo-Australian Archipelago and Southeastern Thailand. Locally this fish thrives in both brackish and fresh water, and, in addition to the estuary of the Chantabun River, from which the type of *Vaimosa spilopleura* came, it has been found to be common in the Menam Chao Phya at Bangkok, in the Bangpakong, and in the Tachin.

A length of about 7 cm. is attained in Thailand. Bleeker reported fish up to 8.5 cm. from Singapore and Java.

Examples from a canal in Bangkok, kept in a small jar of fresh water for several months, thrived on a diet consisting chiefly of mosquito larvae, and increased in size.

The fish shares with other gobies the vernacular name of *pla bu.*

Genus ACENTROGOBIUS Bleeker

Acentrogobius Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 321, 1874. (Type, *Gobius chlorostigma* Bleeker.)

Local species referable to this genus are numerous and not always readily distinguishable from one another. They are mostly to be found in estuaries and the mouths of rivers, and show a tendency to extend their movements upstream, so that they are sometimes captured in fresh water.

The combination of features by which fishes of this genus may be distinguished from *Ctenogobius* and *Vaimosa*, as indicated in the key to the family, is: Squamation extending on the top of the head to the posterior edge of the eyes; opercle and preopercle scaled, partly scaled, or naked; teeth in several rows in each jaw, some of them enlarged, with the outer row in the lower jaw extending only half the length of the jaw and the last teeth recurved canines. In *Ctenogobius* the head is entirely naked except, sometimes, for a line or band of scales extending backward from each eye, and the teeth are similar to those in *Acentrogobius.* In *Vaimosa* the top of the head is scaled to the eyes and a patch of large scales more or less covers the opercle; and none of the teeth is enlarged.

Very close to *Acentrogobius*, and not always easily separable therefrom, are fishes assigned to the genus *Gnatholepis.* While *Acentrogobius* may have the preopercles and opercles fully scaled, in *Gnatholepis* these parts are always scaled, with the scales extending under the eyes, usually in regular horizontal rows, and sometimes divided into two or three groups or series by horizontal grooves. According to Dr. Kouman's latest conclusions regarding these fishes, the only character separating *Acentrogobius* from *Gnatholepis* is the width of the isthmus, which is wider in *Acentrogobius* because the gill openings are more restricted.

With the exception of *A. nebulosus*, of which too few specimens are available for comparison with other species, the Thai representatives of the genus *Acentrogobius* are distinguishable by the following characters:

1a. About 30 or fewer scales in longitudinal series.
  2a. Upper pectoral rays free and silklike; no scales on opercle or preopercle; scales in longitudinal series 26 to 28, in transverse series 9, in predorsal region 10 to 12; body and head green to yellow, with 6 to 8 longitudinal lines of dark brown or black spots, several of the lower rows of larger, elongate spots; all fins except ventrals with rows of dark spots; ventrals brown or black ---------- ornatus
  2b. Upper pectoral rays not free and silklike.
    3a. Opercle and preopercle scaleless.
      4a. Predorsal scales about 21; scales in longitudinal series about 28, in transverse series 9, body and head light brown; 4 diffuse dark brown spots along middle of side alternating with 4 similar spots on back; a large round black spot at upper end of gill opening; first dorsal fin rich brown, most intense on either side of fifth and sixth rays, and dorsal fin elaborately decorated with brown and plumbeous in transverse lines, with a narrow brown border, a series of elongate plumbeous spots edged above and below with a narrow colorless stripe, a broad median band of brown and plumbeous, and a basal band of plumbeous spots separated from the median band by a clear line; caudal rays brown, membranes mostly clear; anal fin dusky; ventral fins with central part plumbeous; pectorals pale brown. simulans
      4b. Predorsal scales about 9 to 14; scales in longitudinal series about 30, in transverse series 8 or 9.
        5a. Any or all of first 3 dorsal spines in male produced into a long slender filament.
          6a. General color green, each scale of back and sides with a round spot of pearly blue; a blue-black spot at upper angle of gill opening; first dorsal fin green to yellowish, with a basal row of pale yellow spots; second dorsal, caudal, and anal fins dark violet to black, with transverse rows of white spots and with a very narrow edge of red or orange; ventrals black, with red tips; pectorals black, with narrow light margin and broad green base. cyanomos
          6b. General color dusky, with obscure darker blotches; dorsal, anal, and ventral fins dusky purple; caudal and pectoral fins deep orange or orange-red, the pectorals purplish at base, the caudal with small black spots on membranes forming 6 to 8 transverse bands ---------- oligactis
        5b. None of rays of first dorsal fin produced into a long slender filament.
          7a. A brown spot at upper base of caudal fin; body green, with snowy spots; each scale of side with a round brown spot. chlorostigmatoides
          7b. Five brown blotches or doubled spots along midaxis of body, the last at midbase of caudal fin; smaller and fainter brownish spots on body ---------- reichei

3*b*. Upper part of opercle scaled.

8*a*. Body and head light brown, a round dark brown spot on each scale of 3 abdominal rows of scales; all fins except pectorals black or blackish, pectorals dusky; a small black spot at upper base of caudal fin. **atripinnatus**

8*b*. Body and head olive, with a blue or pearly spot on each scale and some blackish spots along side; all fins except pectorals black; pectorals yellow, with black margin---------------------------------- **masoni**

8*c*. Body and head green, with about 5 black dorsal blotches, the first on head behind eye, the last under posterior end of second dorsal, and with about 5 roundish black spots along middle of side; at upper end of gill opening a large round lustrous emerald-green spot; side of head with small green spots; each scale on side of body with a golden green spot-- **caninus**

1*b*. Thirty-four to 40 scales in longitudinal series; scales in transverse series 12; predorsal scales 30 to 32; general color olivaceous to dusky, with a series of indistinct dark blotches along side; a large emerald-green shoulder spot, and nape and sides of head variously spotted with green; many scales along sides have emerald-green spots; fins variously tinged with pink, blue, or violet; second dorsal with a submarginal green band and a light edge; caudal, anal, and ventrals dark green to blackish, caudal with a lavender upper edge, anal sometimes gray, with a submarginal green band-- **viridipunctatus**

ACENTROGOBIUS ORNATUS (Rüppell)

Gobius ornatus Rüppell, 1828, p. 135 (Massaua, Red Sea).

One of the most beautiful of the local gobies, this species ranges from the east coast of Africa to Australia, the East Indies, Philippines, Samoa, and Fiji. The numerous specimens taken in Thailand have come from Koh Samui, in the western part of the Gulf of Siam; from Koh Chang, Koh Chik, Sriracha, and the Chantabun Estuary, in the Southeastern district.

The maximum length of local specimens is 8.7 cm. Examples of 7 to 8 cm. are common.

This is the only local species in which the upper pectoral rays are free and silky, a feature that, with the characters noted in the key, makes identification easy.

The fish shares with some of the related forms the vernacular name of *pla bu hua to* (big-head goby).

ACENTROGOBIUS SIMULANS (H. M. Smith)

Rhinogobius similis Smith, 1931a, p. 43 (Bandon Bight).
Rhinogobius simulans Smith, 1931c, p. 64 (substitution of new specific name).

Described in 1931 from specimens, 7.7 and 6.6 cm. long, from Bandon Bight, an arm of the Gulf of Siam in Peninsular Thailand, this species has not since been reported. Through an oversight to which Dr. Carl L. Hubbs drew the writer's attention, the specific name first applied to the fish was preoccupied for a Japanese species that was the type of the genus *Rhinogobius.*

ACENTROGOBIUS CYANOMOS (Bleeker)

Gobius cyanomos Bleeker, 1849 (15), p. 25 (Surabaya, Kammal).
Acentrogobius spilopterus Smith, 1932a, p. 259, pl. 23, fig. 2 (Tachin River).
Acentrogobius cyanomos Koumans, 1937b, p. 178 (Tachin River).
Gobius cyanosmos Fowler, 1939, p. 53, (Krabi).

The range of this goby covers the Indo-Australian Archipelago and extends to the northern shores of the Gulf of Siam, where it is abundant in places.

The second and third dorsal spines are usually elongated and filiform, and the second spine may extend beyond the base of the second dorsal fin or even to the caudal. This feature, which is characteristic of the male, is combined with peculiar coloration: The green back and sides have each scale with a spot of pearly blue, a large round spot at the upper angle of the gill opening is blue-black, and the very dark second dorsal and caudal fins have rows of white spots on the interradial membranes.

The maximum length of local female specimens so far recorded is 11.5 cm., the males being larger. A female, 8.2 cm. long, taken in the Tachin River in December contained nearly ripe eggs.

The nominal species *A. spilopterus* was considered by Koumans as agreeing with *A. cyanomos*, to the types of which he had access in the Leiden Museum, and this conclusion of Koumans is accepted.

The vernacular name is *pla bu.*

ACENTROGOBIUS OLIGACTIS Bleeker

Acentrogobius oligactis Bleeker, 1875 (461), p. 132 (Singapore).

Described in 1875 from three specimens, 4.1 to 4.8 cm. long, taken at Singapore, this species has rarely been observed since. It is possible to record it from Southeastern Thailand on the basis of a specimen, 3.8 cm. long, taken on the shore of Koh Chang on April 15, 1925, and another specimen, 4 cm. long, taken on Koh Kut on May 25, 1929. Both of these specimens were examined and identified by Dr. F. P. Koumans with Bleeker's types at hand.

ACENTROGOBIUS CHLOROSTIGMATOIDES (Bleeker)

Gobius chlorostigmatoides Bleeker, 1849 (15), p. 26 (Surabaya and Kammal).

This little goby of Java, Borneo, and other East Indian islands is represented in the collection of the U. S. National Museum by five specimens, 4.3 to 6.9 cm. long, taken by the writer in the Bangpakong River, Central Thailand, June 26, 1933; one, 5.1 cm. long, from the

Gulf of Siam at Sriracha, Southeastern Thailand, June 14, 1927; and one, 9.6 cm. long, from the inner lake of the Tale Sap, Peninsular Thailand, July 4, 1924. These specimens were examined by Dr. Frederick P. Koumans in connection with his study of Bleekerian goby material in the Royal Natural History Museum in Leiden, Holland, and found to agree with the types.

ACENTROGOBIUS REICHEI (Bleeker)

Gobius reichei Bleeker, 1853 (86), p. 509 (Padang, Sumatra).

Described by Bleeker in 1853 from a single specimen, 5.5 cm. long, from a river in Padang, Sumatra, this species has rarely been noted in literature since Bleeker's time. Among a collection of goboid fishes from the Andaman Islands Koumans (1940, p. 15) found 22 specimens of this species, recorded without comment or description. Two specimens from Thailand waters in the U. S. National Museum are referred to this species, after having been carefully compared with the original description. One, 4.5 cm. long, was taken on Koh Chang, Gulf of Siam, June 26, 1929. The latter specimen was identified as *A. reichei* by Dr. Koumans after comparison with Bleeker's type.

The side of this fish is marked by a conspicuous longitudinal row of dark spots, about 5 in number, which are double or triple, as pointed out by Bleeker. The specimens in hand have on the cheek a patch of papillae, which is more prominent than in any other local species, but is not referred to in any published description. The patch is oblong, extends from the upper lip to the sulcus between the opercle and preopercle, and consists of 7 or 8 horizontal rows of small papillae. Other conspicuous lines of papillae extend under the eye and along the ramus of the lower jaw and thence backward along the lower edge of the cheek to the operculo-preopercular groove, in which is a prominent vertical row of papillae.

ACENTROGOBIUS ATRIPINNATUS (H. M. Smith)

Rhinogobius atripinnatus Smith, 1931a, p. 45 (Gulf or Siam off Tachin River).

This goby is known from a few specimens, 6 to 8.5 cm. long, from the Menam Chao Phya at Paknam, the Gulf of Siam off the mouth of the Tachin River, the estuary of the Chantabun River, and the outlet of the Tale Sap at Singora. The uniform light brown color of the body and head is in contrast with black dorsal, caudal, anal, and ventral fins, the pectorals being dusky. The head is crossed by lines of papillae most conspicuous across the cheeks. In a specimen, 6.8 cm. long, from Singora each scale of 3 ventral rows has a round, rich brown basal spot, these spots being only very faintly discernible in the type.

The type, 6 cm. long, taken in December, was a female with well-developed ovaries.

ACENTROGOBIUS MASONI (Day)

Gobius masoni Day, 1873, p. 107 (Bombay).
Ctenogobius masoni Fowler, 1937, p. 252, fig. 281 (Paknam, Tachin).

Described from Bombay in 1873 under the name *Gobius masoni*, this species was identified by Fowler (1937) as being represented by three specimens, 4.9 to 6.7 cm. long, from the lower Menam Chao Phya and Tachin Rivers. The fully scaled predorsal region, with the scales extending to the eyes, and the presence of scales on the opercles do not conform with the accepted definition of *Ctenogobius* (*Rhinogobius*), and apparently require the allocation of this species in *Acentrogobius*.

ACENTROGOBIUS CANINUS (Cuvier and Valenciennes)

Gobius caninus Cuvier and Valenciennes, 1837, vol. 12, p. 86 (Java).
Rhinogobius caninus Fowler, 1935a, p. 161 (Bangkok, Paknam).
Ctenogobius caninus Fowler, 1937, p. 252 (Tachin).

From the southern coast of China and the Philippines this species ranges to India. It appears to be represented in all parts of the Gulf of Siam and in the lower courses of rivers debouching therein, and material has been extended from Patani, Singora, and Pak Payoon in Peninsular Thailand, Tachin, Chao Phya, and Bangpakong Rivers in the Central area, and Chantabun Estuary in Southeastern Thailand.

A size commonly attained in Thailand is 9 to 10 cm. The largest local example examined was 12.5 cm., from the Gulf of Siam off Nakon Sritamarat.

The specific name *caninus* refers to the presence of one or two conspicuous canine teeth on each side of the lower jaw at the posterior end of the outer row of teeth. This feature, however, is not peculiar to this species but prevails throughout the genus.

Vernacular names given to this fish in parts of Thailand are *pla bu khao* (white goby) and *pla bu tale* (sea goby).

ACENTROGOBIUS VIRIDIPUNCTATUS (Cuvier and Valenciennes)

Gobius viridipunctatus Cuvier and Valenciennes, 1837, vol. 12, p. 62 (Bombay).
Ctenogobius viridipunctatus Fowler, 1937, p. 252, fig. 280 (Tachin).

From the west coast of India to Thailand and Malaya, this species ranges through the East Indies to the Philippines. It may be recognized by the features indicated in the key. In Thailand it is known from river mouths and estuaries around the Gulf of Siam, although there appears to be only one published record, for the Tachin River.

A length of 12 cm. is attained.

ACENTROGOBIUS NEBULOSUS (Forskål)

Gobius nebulosus FORSKÅL, 1775, p. 24 (Djedda, Red Sea).—FOWLER, 1939, p. 53 (Krabi).

Under the name *Gobius nebulosus* Forskål, a species described from the Red Sea, Fowler listed three specimens, 8.6 to 9.5 cm. long, taken in September 1936 at Krabi, Peninsular Siam. The extension of the predorsal scales into the interorbital space of these specimens suggests their position in the present genus rather than in *Rhinogobius* (or *Ctenogobius*) where Forskål's species was assigned by Jordan and Seale and Jordan and Richardson. It would appear that the present fish is not conspecific with *Rhinogobius nebulosus* Jordan and Seale (1906, p. 401; 1907, p. 41), and Jordan and Richardson (1908, p. 276); with *Rhinogobius lungi* Jordan and Seale (1907, p. 41), a synonym of *nebulosus* according to Jordan and Richardson (1908); and with *Gobius criniger* Cuvier and Valenciennes (1837), which was made a synonym of *nebulosus* by Jordan and Seale (1906) and Jordan and Richardson. In view of the deficiencies in Forskål's description, more particularly as regards squamation and dentition, the species *nebulosus* cannot with certainty be given a generic assignment.

Genus AMBLYGOBIUS Bleeker

Amblygobius BLEEKER (453), Arch. Néerl. Sci. Nat., vol. 9, p. 322, 1874. (Type, *Gobius sphinx* Valenciennes.)

AMBLYGOBIUS PHALAENA (Cuvier and Valenciennes)

Gobius phalaena CUVIER and VALENCIENNES, 1837, vol. 12, p. 92 (Vanikolo).
Amblygobius phalaena SMITH, 1933a, p. 82 (Gulf of Siam).

Widely distributed in the eastern Pacific, this species is known from Thailand by a few specimens taken about islands in the Gulf of Siam, several at Koh Sichang and one at Koh Pa-ngan.

Length, 9 cm. or less.

Genus GNATHOLEPIS Bleeker

Gnatholepis BLEEKER (453), Arch. Néerl. Sci. Nat., vol. 9, p. 318, 1874. (Type, *Gobius anjerensis* Bleeker.)

GNATHOLEPIS CALLIURUS Jordan and Seale

Gnatholepis calliurus JORDAN and SEALE, 1905, p. 796, fig. 14, 1905 (Negros, Philippine Islands).—SMITH, 1931d, p. 189 (Patani).

Described from the Philippines in 1905 and later taken in British North Borneo, this species was ascertained to inhabit Thailand when, in 1927, a pair were taken in the Gulf of Siam at Patani, in Peninsular Thailand. The fish attains a length of 4 to upward of 7 cm., and may be recognized readily by 3 horizontal rows of scales on the cheek and preopercle, with a horizontal groove extending from the upper jaw to the opercle below the upper row of scales, and the presence of scales on the upper part of the opercle, together with a pale brown body marked by a median longitudinal series of dark spots, terminating at the base of the caudal fin in a conspicuous round black spot and a dusky caudal fin set off with 4 or 5 transverse lines or rows of white spots.

The peculiar squamation of the cheek, with the deep horizontal sulcus, differs from the normal squamation of the cheek as seen in what may be considered typical *Gnatholepis*, exemplified by the species *deltoides* of Guam and the Philippines, and may, with several other characters, justify the establishing of a new genus for the accommodation of *calliurus*.

AULOPAREIA, new genus

Genotype.—Aulopareia janetae, new species.

Body elongate, moderately compressed; head cylindrical; eyes small, dorsal lateral, in anterior third of head, separated by a rather wide space; mouth rather large, oblique, lower jaw slightly projecting; teeth pluriserial, outer row in upper jaw comprising 8 fanglike canines, outer row in lower jaw somewhat enlarged, the last tooth on each side a large, recurved canine; tongue with rounded tip; gill openings of moderate extension forward; body, including predorsal region, breast, and base of pectoral fins, completely covered with rather large ctenoid scales becoming cycloid anteriorly; top of head scaled, the scales extending throughout interorbital space to a point nearly in line with the anterior margin of each eye; no obvious pores in interorbital space; opercle, preopercle, and cheek fully scaled, the scales on cheek extending as far forward as anterior edge of eye and arranged in 6 horizontal rows separated by narrow grooves or furrows; dorsal rays VI–I, 10; anal rays I, 9; caudal fin short, bluntly pointed.

In having the opercle, preopercles, cheeks, and top of head densely scaled this genus resembles *Gnatholepsis;* but in the extension of the scales throughout the interorbital space, in having the numerous horizontal rows of scales on the cheeks separated by four horizontal grooves, in the cylindrical head with wide interorbital space, and in various other characters, this genus stands apart. There is rather close similarity to *Exyrias*, with the type species of which genus, *Gobius puntang* Bleeker, it has been compared, but in that form the head is compressed, the interorbital space is narrow (0.5 eye or less), with a pair of conspicuous pores, the posterior nostril is well separated from the eye, and scales extend only to the posterior half of the interorbital space.

AULOPAREIA JANETAE, new species

Figure 105

Description.—Depth 4.5 in standard length; depth of caudal peduncle 1.8 in its length and 2 in head; head broad, 3.6 in standard length; snout blunt, 3.8 in head; eye extending to dorsal profile, small, about 5.8 in head, 1.5 in snout, and 1.2 in the flat interorbital space; mouth oblique, maxillary extending beyond middle of eye, 2.5 in head; teeth in outer row of upper jaw caniniform, about 4 on each side; teeth in outer row of lower jaw enlarged in front, the last tooth on each side a large, recurved canine; tongue thick, fleshy, its tip rounded; gill openings extending forward for a moderate distance, the isthmus broad; posterior nostril close to eye.

Squamation: Body covered with large ctenoid scales becoming cycloid forward, about 30 in longitudinal series, 10 in transverse series, 20 predorsal, and 12 circumpeduncular; breast and pectoral base scaly; predorsal scales extending through interorbital space nearly to a line connecting anterior margin of eyes; opercle, preopercle, and cheek fully covered with large cycloid scales, those on preopercle and cheek in 6 rows traversed by 4 horizontal grooves.

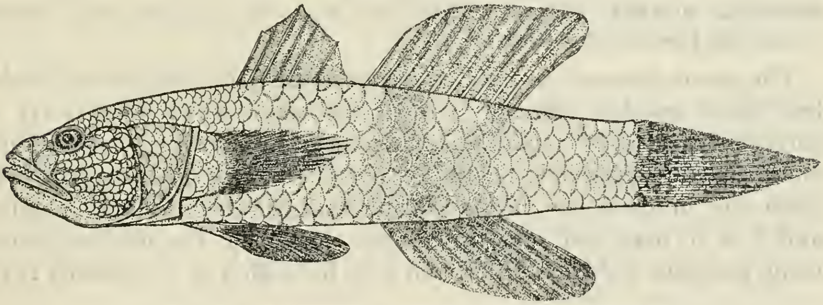


Figure 105.—*Aulopareia janetae*, new species: Type (U.S.N.M. No. 119548). Drawn by Mrs. Alice C. Mullen.

Fins: Dorsal rays VI–I, 10; first dorsal fin low, rays 0.5 head; branched rays increasing in length from before backward, the last rays about 1.5 in head; caudal fin less than head, obtusely pointed; anal rays I, 9, similar to second dorsal; ventrals shorter than head, frenum deeply emarginate; pectorals pointed, about length of head, with 19 rays, of which the longer central rays reach beyond ventrals.

Coloration (in preservative): Body and head pale, unmarked; all fins more or less uniform reddish brown; a blackish spot about size of eye at upper base of caudal fin, with a pale area posteriorly.

Type and paratype.—The type (U.S.N.M. No. 119548), a specimen 7.6 cm. long, was taken July 22, 1928, in Nakon Bay, off the east coast of Peninsular Thailand. A paratype and only other known specimen

(U.S.N.M. No. 119549), 7.1 cm. long, was obtained at the same time and place.

Remarks.—The type and paratype of this species were examined by Dr. Koumans in 1938 and considered by him as representing an undescribed *Acentrogobius*. For reasons elsewhere given this view cannot be accepted unless the limits of *Acentrogobius* are extended beyond the scope of that genus as set forth in Koumans' various papers. The present fish is much closer to *Gnatholepis* than to *Acentrogobius;* these genera were practically synonymized by Koumans (1935) when he gave, as the only character separating them, the degree of the forward extension of the gill openings, although in his 1931 paper he rejected the suggestion that they are synonymous. It is believed that the variability of the feature relied on by Koumans excludes its use as a differential generic character. Specimens in the U. S. National Museum regarded as representative of typical *Gnatholepis* (*deltoides* (Seale) from Samoa and *thompsoni* from Cuba) have the extension of the gill openings as Koumans prescribes for *Acentrogobius*.

Named for the writer's daughter, Janet Elizabeth Claudy.

Genus ZONOGOBIUS Bleeker

Zonogobius Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 323, 1874. (Type, *Gobius semifasciatus* Kner.)

The genus *Zonogobius* may be recognized by the compressed, scaleless head; scaleless anterior part of the body, which posteriorly is covered with 20 to 30 ctenoid scales in longitudinal series; large, oblique mouth; teeth pluriserial in both jaws, outer row enlarged in upper jaw, inner row in lower jaw, no postsymphyseal or other canines; 6 spines and 8 to 10 branched rays in the first dorsal fin, the median spines being elongate and threadlike; and anal fin with 8 or 9 branched rays.

ZONOGOBIUS SEMIDOLIATUS (Cuvier and Valenciennes)

Gobius semidoliatus Cuvier and Valenciennes, 1837, vol. 12, p. 67 (locality not given.

Zonogobius semidoliatus Smith, 1934b, p. 325 (Southeastern Siam).

The wide range of this minute goby of the Pacific and Indian Oceans on coral reefs covers Thailand where, however, it is known only from a few specimens, 14 to 21 mm. long, taken in a tide pool at Lem Sing, Southeastern Thailand. The fish may undoubtedly be found in suitable localities on other parts of the Thai coast.

Because of the striking coloration the species may be identified without difficulty. The head and body are dark red and the head and anterior part of the body are crossed by 7 to 10 or more whitish black-edged bands; all the fins except the ventrals are orange or yellow with the rays bearing small dark red spots tending to form lines that are especially well marked on the caudal fin; ventral fins dark red.

Genus VAIMOSA Jordan and Seale

Vaimosa JORDAN and SEALE, Bull. U. S. Bur. Fisheries, vol. 25, p. 395, 1906. (Type, *Vaimosa fontinalis* Jordan and Seale.)

Under this name is included a large number of Oriental gobies inhabiting fresh-water streams, estuaries, and the shores of islands and coasts. The essential differential features ascribed to the genus are the presence of large scales on the opercle, the absence of scales on the preopercle and cheek, the presence of scales on the top of the head posterior to or between the eyes, and no enlarged teeth in either jaw. The genus is in contrast with *Ctenogobius*, in which the head is entirely naked except for a possible band of scales posterior to the eye, with *Gnatholepis* in which the opercles and cheek are fully scaled, and with *Acentrogobius* in which the opercle and preopercle are fully scaled, partly scaled, or naked, and some teeth in both jaws are caninoid and the posterior teeth in the lower jaw are recurved canines. Relations with *Stigmatogobius* are indicated under that genus.

The status of *Vaimosa*, described from Samoa in 1906, has become unnecessarily involved. Jordan (1920, pt. 4, p. 519) made *Vaimosa* a synonym of *Mugilogobius* of Smitt (1899), following Jordan, Tanaka, and Snyder (1913, p. 345), who indicated *Ctenogobius abei* Jordan and Snyder as the type of *Mugilogobius* on the basis of a personal letter written by Smitt in 1903, in which he stated that his type species was the one named *Ctenogobius abei* in 1901.

It is unfortunate that *Mugilogobius* should ever have been regarded as a valid genus, and nomenclatural propriety will best be served by suppressing it if a proper way can be found. Aside from the fact that no species was named, the genus as defined by Smitt is wholly unrecognizable. Features of cardinal importance in the determination of the genera of gobies, such as dentition, squamation, and fin formulae, are entirely disregarded, and not a single diagnostic character is mentioned. It seems unjustifiable to attempt to validate the genus as of the date of its establishment by accepting as the genotype a species that was undescribed at the time the genus was set up and was first made known two years later. Accepted international rules of zoological nomenclature appear to cover this situation either directly or by implication. Thus, in Opinion No. 46, dealing with the status of genera for which no species was named in the original publication, it was held that no species is available as genotype unless it can be recognized from the original generic description. Such recognition being quite impossible in this case, it would seem that this genus must, for this and other obvious reasons, have a very tenuous standing.

If, however, *Mugilogobius* can be accorded a degree of validity, it is the opinion of the present writer that the validity should date from the first published correlation of the name with a genotype, in 1913.

Such a course would preclude the acceptance of *Vaimosa* (1906) as a synonym of *Mugilogobius* as was done by Jordan, Tanaka, and Snyder, and would make the latter a synonym of the former. It may be of interest to record Dr. Jordan's later views on this question, as embodied in a personal letter to the writer dated April 24, 1925: "I decided at one time that *Vaimosa* was not distinct from *Mugilogobius* of Japan. Later study convinces me I was mistaken."

Three species of *Vaimosa* from Thailand may be characterized as follows:

1*a*. Scales in longitudinal series 37, in transverse series 13, in predorsal region 18; dorsal rays VI–I,8, anal rays I,8; general color of body and head heliotrope gray, each scale of back and side with a narrow lunate spot of reddish brown; abdomen yellow-green to pale orange; 6 or 7 strongly curved parallel dark brown cross lines extending across under side of head, the first immediately behind lower lip; dorsal fins with transverse bands of heliotrope gray, white, and dark purplish gray; caudal fin pale apple green, with 7 or 8 curved, wavy, cross stripes of heliotrope gray---rambaiae

1*b*. Scales in longitudinal series 27 to 31, in transverse series 8, in predorsal region 11 or 12; dorsal rays VI–I,7, anal rays, I,7; general body color light yellowish green; back and sides with numerous blackish brown lines some of which form about 6 or 7 irregular cross bands which meet on back; abdomen dull orange; dorsal fins with black bands, blotches, and series of spots; caudal fin with a dark vertical bar at base and immediately behind it a pair of rounded blue-black spots-------------------------- chulae

1*c*. Scales in longitudinal series 23 to 26, in transverse series 8, in predorsal region 6 or 7; dorsal rays VI–I,6, anal rays I,6 or I,7; general color pale brown, lighter below; 5 dark brown saddles alternating with a series of dark bars along side; first dorsal pale, with a blackish area posteriorly; second dorsal pale, with small dark spots on each ray; caudal with 4 or 5 curved transverse dark cross bars-------------------------- siamensis

VAIMOSA RAMBAIAE, new species

PLATE 9, *a*

Description.—Body moderately compressed, the depth about 5 in standard length; caudal peduncle rather long, its least depth 2 in its length and 1.8 in length of head; head blunt, slightly depressed, 4 in length, its width 0.8 its length; eye equal to snout, 5 in head; mouth rather small, somewhat oblique, maxillary extending under anterior part of eye; teeth small, pluriserial, none greatly enlarged.

Squamation: Scales feebly ctenoid, becoming smaller and crowded anteriorly; about 40 in longitudinal series, 12 in transverse series, 19 predorsal to posterior margin of eyes, and 12 circumpeduncular; opercle covered with large thin scales; skin of head deficient in conspicuous pores but marked by prominent papillae, one line extending from snout over posterior nostril and over eye to a point behind eye where it joins a short horizontal line extending backward, and 4 parallel lines on side of head below eye.

Fins: Dorsal rays VI–I, 8; first 5 simple rays of nearly equal length and less than 0.5 head; origin of first dorsal fin over middle of extended pectoral and midway between tip of snout and posterior end of base of second dorsal; free edge of second dorsal straight, the rays gradually increasing in length so that last ray is twice length of first; caudal fin evenly rounded, fan shaped, shorter than head; anal I, 8, similar to second dorsal; ventrals reaching halfway to anal; pectoral rays 15, the base broad and scaly.

Life colors: Entire body and head except abdomen soft heliotrope gray; back with about 5 indistinct darker bands, which extend obliquely downward and forward to middle of side, the first band under first dorsal fin; each scale of back and side with a narrow reddish brown lunate spot; abdomen yellow-green; underside of head with 7 dark brown, strongly curved, parallel cross lines, the first one immediately behind and following curvature of the lower lip; first dorsal grayish-green on basal half, heliotrope gray on free edge; with a submarginal transverse band of white involving the first 5 membranes and basally thereto a dark purplish gray band, which merges into the green shade at the base of the fin; second dorsal similar to first, but with a row of elliptical dark purplish gray spots in the paler purplish median band, a spot on each membrane; entire caudal fin uniform pale apple green, with about 7 curved, wavy, cross stripes of heliotrope gray; anal pale grayish-blue at base, pale lavender distally, all rays heliotrope gray; ventral and pectoral fins pale green to greenish yellow.

Type.—The type (U.S.N.M. No. 119646) is a female, 3.9 cm. long with well-developed eggs, taken in a canal in Bangkok May 28, 1931. A paratype is U.S.N.M. No. 119647.

Remarks.—This species has as yet been found only in a small canal within the city of Bangkok. Many specimens collected in May 1931 were kept in good condition in a small balanced aquarium in the Siamese Bureau of Fisheries until December of the same year, when they were preserved. During that time they ate mosquito larvae, other small insects, and minute crustaceans, and throughout captivity retained their strikingly rich coloration.

The species exhibits minor variations in relative length of head and depth of body, in squamation, and in details of coloration.

Special permission to use her name for this species was obtained from Her Majesty Rambai Barni, former Queen of Siam, and at a reception and exhibit given by the Siam Society in honor of their majesties on January 8, 1934, a water-color painting, made by the talented Thai artist Luang Masya Chitrakarn, was presented to her majesty. The painting represented several life-size examples of the fish in their natural habitat. (See Journ. Siam Soc., vol. 20, pp. 253–254, 1935.)

VAIMOSA CHULAE H. M. Smith

Vaimosa chulae SMITH, 1932a, p. 260, pl. 23, fig. 3 (Koh Samui and Southeastern Siam).—FOWLER, 1937, p. 251, fig. 262 (Tachin).

This little fish, which reaches a maximum size of about 4 cm., has been found in various places around the Gulf of Siam. The type and paratypes came from a brackish pool on Koh Samui; other specimens have been examined from the Chantabun Estuary and the lower Tachin River. Some fish as small as 2.7 cm. in total length are fully mature, as shown by the presence of well-developed ova. A paratype in the U. S. National Museum bears the number 119645.

The fish is strikingly colored. The blackish brown lines that cover the body with a peculiar pattern, having a tendency to form about 6 irregular cross stripes, contrast strongly with the pale yellow background and the orange belly; a blackish brown bar, extending forward and upward from the base of each pectoral to the back, is joined with its fellow by a thin stripe across the back; the muzzle, opercles, and lower jaw are plumbeous; the spinous dorsal fin has an oblique black median band, a black area at the base of the first 2 or 3 membranes and another on the distal part of the second membrane; second dorsal with black spots at its base, a line of roundish black spots across its basal part, and a black band or stripe across its distal half, its outer hyaline part with a dusky edge; caudal membranes blackish; anal dusky to black, its narrow margin hyaline.

The sexes are similar, but the vertical fins are less developed in the females, which lack the greatly produced filamentous tips of the second and third dorsal spines observed in adult males, as shown in the figure of the type.

VAIMOSA SIAMENSIS Fowler

Vaimosa siamensis FOWLER, 1934a, p. 157, fig. 125 (Bangkok).—FOWLER, 1935a, p. 161 (Bangkok).

Described from a single specimen, 4 cm. long, from the Silom Canal in Bangkok, this fish was subsequently made known by Fowler from three specimens 3.5 to 3.7 cm. long from the same locality. It was found by the writer to be common in several other Bangkok canals, and 40 specimens 1.8 to 3.8 cm. long were preserved from the Bang Kapi Canal in May 1934. The Bangpakong River is also a habitat of the fish.

The species may be known by the large mouth (extending under posterior edge of eye), slightly protruding lower jaw; swollen cheeks;

large scales (23 to 26 in longitudinal series, 7 or 8 in transverse series, and 5 to 7 in the predorsal region); reduced number (6) of branched rays in the dorsal and anal fins; and coloration (5 rather diffuse dark brown saddles on the back, a series of longitudinal elongated dark bars along the side, transverse rows of dark spots on the second dorsal rays, and 4 or 5 curved black transverse bars on the caudal fin). In what appear to be only younger specimens the maxillary extends only to a point under the pupil. A feature shown by all specimens regardless of size is a black line along the median ventral edge of the caudal peduncle, with a thickening of the line into 3 elongate evenly spaced spots, not mentioned in the original description.

A series of 14 specimens, 2 to 3.2 cm. long, from the Bangpakong River, July 1923, were pale and all were females having ripe or ripening eggs.

Genus GLOSSOGOBIUS Gill

Glossogobius Gill, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 146. (Type, *Glossogobius platycephalus* Richardson).

Features by which the gobies of this genus may be recognized are depressed head, large mouth, strongly projecting chin, pluriserial teeth with outer row canine or caniniform, deeply notched or bilobed tongue, wide gill openings, rather large ctenoid scales which extend to the eyes, with a few on opercles, branched dorsal rays 8 to 10, and branched anal rays 7 to 9. In addition to the two species shown in the key, there are ascribed to Thailand several nominal forms (*G. kokius*, *G. circumspectus*) which the writer follows Koumans (1935) in synonymyzing with *G. giuris*. The two species definitely ascribed to Thailand are distinguishable as follows:

1*a*. A circular projection from upper iris into pupil; 2 dark ocelli on first dorsal fin ---------- biocellatus
1*b*. No projection from iris into pupil; no ocellus on first dorsal fin------ giuris

GLOSSOGOBIUS BIOCELLATUS (Cuvier and Valenciennes)

Gobius biocellatus Cuvier and Valenciennes, 1837, vol. 12, p. 73 (Pondicherry).

Ranging from eastern India to Malaya, East Indies, Philippines, Australia, and Polynesia, this species has not been reported previously from Thailand and it is apparently rare in that country. One specimen, 8.5 cm. long, was taken by the writer at Singora, in the Peninsula, in October 1923, and another, 10.1 cm. long, in the Krat River, Southeastern region, in December 1933, the latter representing about the maximum size attained by the species.

The peculiar extension from the upper part of the iris into the pupil and the two dark ocelli on the spinous dorsal fin make identification easy.

GLOSSOGOBIUS GIURIS (Hamilton)

Gobius giuris Hamilton, 1822, p. 51, pl. 33, fig. 15 (Ganges).—Károli, 1882, p. 164 (Bangkok).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Boulenger, 1903, p. 303 (Patani River).

Gobius kokius Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).

Glossogobius giuris Hora, 1923b, p. 178 (Bangkok, Nontaburi).—Vipulya, 1923, p. 223 (Bangkok).—Fowler, 1937, p. 252 (Bangkok, Paknam, Tachin); 1939, p. 53 (Krabi).

Glossogobius kokius Hora, 1924a, p. 493 (Tale Sap).

Glossogobius circumspectus Hora, 1924a, p. 493 (Tale Sap).

Glossogobius giurus Fowler, 1934a, p. 159 (Bangkok); 1934b, p. 351 (Ban Thung Luang); 1935a, p. 160 (Bangkok, Paknam, Keng Sok).

In Thailand, as in the other parts of its wide range (Africa, Australia, India, East Indies, Malay Peninsula, Philippines, Indo-China, China), this fish occurs in both salt and fresh water. It is the commonest and most generally distributed of the Gobiidae in the coastal waters of Thailand, being found along the entire coast of the Gulf of Siam and in the lower courses of all the rivers. Waters in which the species has been actually collected are: Menam Chao Phya at Bangkok, Bangsorn, and Nontaburi; Meklong at Rajaburi; Tale Sap in inner and outer lakes; Patani River; Bangpakong River; at mouth of Chantabun River, in estuary of the Chantabun River at Lem Sing, in Krat River at Ban Taeng, in Klong Raibon, and in Wain River at Paknam Wain. The point farthest inland where the fish has been found is Ban Pan in the Sikuk River, Central Thailand.

The maximum size observed in Thailand is about 30 cm. In some other countries a length up to 45 cm. is reported.

The eggs as laid are attached to the lower side of rocks and timbers, in streams, klongs, and lakes.

Owing to its considerable size and abundance, this goby locally is caught and consumed in large quantities, and is economically the most valuable of the local gobies, although in flavor and texture of flesh it does not have a high rank.

The fish bites freely at almost any kind of animal bait, and is caught in large numbers by anglers. It is also taken with traps, seines, and the various kinds of bag nets used in coastal waters and lower courses of rivers.

The usual vernacular name given to this fish is *pla bu*. In the Menam Chao Phya *pla bu sai* (sand goby) and *pla bu tong* (golden goby) are heard. A name in use on the Meklong at Rajaburi is *pla bu hin* (rock goby). In the inner lake of the Tale Sap the fish is called *pla sai* (sand fish), while at Singora, at the outlet of the Tale Sap, a name reported is *pla luk sai* (sand-fruit fish).

Genus CREISSON Jordan and Seale

Creisson Jordan and Seale, Bull. U. S. Bur. Fisheries, vol. 26, p. 43, 1907. (Type, *Creisson validus* Jordan and Seale.)

CREISSON SEALEI H. M. Smith

Creisson sealei Smith, 1931a, p. 41 (lower Menam Chao Phya).

Possessing the outstanding generic characters of the genotype, *C. validus* Jordan and Seale from the Philippines, this species may be distinguished therefrom in that it has about 40 scales in longitudinal series (against 29 to 32), 13 scales in transverse series (against 10 or 11), 34 scales between the first dorsal fin and the eyes (against about 17), branched anal rays 9 (against 7 or 8), markedly different coloration of dorsal and caudal fins, and other characters. The type, 15 cm. long, taken in the Menam Chao Phya at Paknam, May 30. 1930, remains unique.

Genus OLIGOLEPIS Bleeker

Oligolepis Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 318, 1874. (Type, *Gobius melanostigma* Bleeker.)

OLIGOLEPIS MOLOANUS (Herre)

Aparrius moloanus Herre, 1927, p. 207 (Panay, Philippine Islands).
Oligolepis moloanus Smith, 1933a, p. 80 (Chantabun Estuary).

This fish, described as new by Herre (1927) from the island of Panay, Philippine Islands, and placed in the genus *Aparrius* of Jordan and Richardson (1908, p. 278), is regarded by Koumans (1931, p. 74) as belonging in the genus *Oligolepis* of Bleeker after an examination of a specimen, *Gobius acutipennis* Cuvier and Valenciennes, the type species of *Aparrius*.

Genus CTENOGOBIUS Gill

Ctenogobius Gill, Ann. Lyc. Nat. Hist. New York, vol. 6, p. 374, 1858. (Type, *Ctenogobius fasciatus* Gill.)

The fishes herein placed in the genus *Ctenogobius* (1858) have been variously allocated by different authors at different times in *Rhinogobius* of Gill, *Tukugobius* of Herre, etc. *Ctenogobius* was based on a fish (*C. fasciatus*) from the fresh waters of Trinidad, but the original description was inadequate and partly inaccurate, and, in the absence of a type specimen, some doubt has persisted as to certain characters, although Gill subsequently amplified and corrected his description. The genus *Rhinogobius* dates from 1859 and was based on a species (*similis*) from Japan. This species, with many others, was called *Ctenogobius* by Jordan and Snyder (1901, p. 54); but Jordan, Tanaka, and Snyder (1913, p. 340) suppressed *Ctenogobius* and used *Rhinogobius* for the same group of fishes. Koumans (1931, p. 88) synonymized *Rhinogobius* with *Ctenogobius*, stating that he had examined specimens of the type species of *Ctenogobius* and *Rhinogobius* and could find no points of difference for separating the genera. Finally, it may be noted that Herre (1933) stated that "authors have confused *Ctenogobius* and *Rhinogobius*, although an examination of the type species will show good generic differences," although Herre (1927, p. 177) had suggested that *Rhinogobius* was probably a synonym of *Ctenogobius*.

In the present treatment it is intended to use the generic name *Ctenogobius*, with the following specifications: Body covered with ctenoid scales of moderate size, becoming cycloid anteriorly; opercles, preopercles, and cheeks naked; predorsal scales variable but not extending to or between eyes; teeth pluriserial, outer enlarged, outer row in lower jaw extending only half length of jaw and possibly terminating in a curved canine; tongue rounded, truncate or very slightly emarginate (exceptionally mucronate); dorsal rays VI–I, 8 to 13, anal rays I, 7 to 10; ventrals united into a circular disk, with the frenum bilobed, crenate, or nearly entire; caudal fin rounded, obtusely pointed, or nearly truncate.

The members of this genus in Thailand are found in salt, brackish, and fresh water. To render complete the account of the known local representation of the genus, it is thought desirable to include several species that are not of a strictly fresh-water habitat. Some of the local species may prove to be improperly included in this genus, but the information now available regarding them does not indicate the propriety of other allocation.

The following species are recognized from Thailand:

1*a*. Scales in longitudinal series 43 to 45, in transverse series between origin of second dorsal and anal fins 15 to 17, in predorsal region 18 to 22; a black white-edged ocellus at upper base of pectoral fin; a large black spot at upper base of caudal rays........ ocellatus
1*b*. Scales in longitudinal series 35 or less, in transverse series 12 or less, in predorsal region none to 10.
  2*a*. Scales in longitudinal series 30 to 35, in transverse series 9 to 12.
    3*a*. Predorsal scales none; anal rays I, 9; second and third dorsal spines elongated in male; sides of head with no sharply defined round dark spots........ criniger
    3*b*. Predorsal scales 6 or 7; anal rays I, 7; dorsal spines not elongated; sides of head thickly covered with round dark brown spots.. cephalopardus
  2*b*. Scales in longitudinal series 25 to 28, in transverse series 6 to 11.
    4*a*. Predorsal scales none to 4; second and third dorsal spines not elongated.
      5*a*. Scales in transverse series 6; tongue mucronate; body with 7 to 11 yellow cross bands........ cylindriceps
      5*b*. Scales in transverse series 8 or 9; tongue rounded.
        6*a*. Body translucent, with 4 or 5 broad black cross bands; head with 2 broad black cross bands, top of head wholly black or suffused with black........ alcockii
        6*b*. Body pale brownish, with 5 large ill-defined dark blotches along side; spinous dorsal with a round black spot nearly as large as eye on basal part of first 2 membranes........ chiengmaiensis

4*b*. Predorsal scales 10; second and third dorsal spines elongated; body with about 5 irregular blackish brown blotches; head with about 5 sharply defined blackish brown bars; dorsal fin with broad pale margin, anal fin mostly blackish________________________ **vexillifer**

CTENOGOBIUS OCELLATUS (Fowler)

Tukagobius ocellatus Fowler, 1937, p. 250, fig. 261 (Kemarat).

The type, 10.3 cm. long, and 3 paratypes, 7.8 to 8 cm. long, came from Kemarat, on the Mekong, in Eastern Thailand. The scales in longitudinal series number 37 to 60 and in transverse series 15 to 17, with 18 to 22 predorsal scales not extending to the eyes. The circular ventral disk has a broadly bilobate frenum. Outstanding color features are brown body with 7 or 8 dark saddles extending from back down to the middle of the sides; a black white-edged ocellus on the upper pectoral base and a distinct round dark or blackish spot on the upper base of the caudal fin.

The genus *Tukugobius*, established by Herre in 1927, was abandoned by him in 1933, when he determined that the essential characters, especially the ventral fins with bilobate circular frenum, were possessed by *Rhinogobius similis* Gill.

CTENOGOBIUS CRINIGER (Cuvier and Valenciennes)

Gobius criniger Cuvier and Valenciennes, 1837, vol. 12, p. 82 (New Guinea).
Ctenogobius criniger Suvatti, 1936, p. 153 (Central, Southeastern, and Peninsular Siam).

While this very widely distributed species, ranging from Africa and Australia to the Indo-Australian Archipelago, Philippines, India, and Southeastern Asia, has been found in various coastal regions of Thailand, there seems to be no published record except that of Suvatti (1936), who listed the fish on the basis of information as contained in a manuscript catalog prepared by the writer. The fish is known, and represented by specimens, from the Menam Tachin in Central Thailand; from Sriracha, Chantabun Estuary, Chantabun River, and Koh Chang in the Southeastern region; and from Singora and Patani in the Peninsula.

A length of 10 to 11 cm. is reached in local waters.

This fish may be recognized by having large irregular blackish or blackish brown blotches on the back and side, interspersed with smaller spots; lines of spots on the second dorsal and caudal fins; and a black edge to the anal fin. The scales in longitudinal series are 28 to 30, in transverse series about 12, the head is either wholly naked or may have a few cycloid scales in a band back of the eye, and there may be a few scattered scales in front of the dorsal fin. The outer row of the pluriserial teeth in each jaw consists of enlarged but scarcely canine teeth, and the most posterior tooth on each ramus of the lower jaw is a small canine. The second and third dorsal spines are greatly prolonged in fully grown males.

The group name *pla bu* is usually applied to this fish. A special vernacular name, shared with several related species, is *pla bu hua to* (big-head goby).

CTENOGOBIUS CEPHALOPARDUS, new species

Figure 106

Description.—Body elongate, moderately compressed posteriorly, cylindrical anteriorly; depth of body about 6 in standard length; length of caudal peduncle 4.25 in standard length, its depth 0.5 its length; head depressed, flattened, its length 3.3 in standard length; eye dorsolateral, protruding above dorsal profile, about 4.4 in head, 1.3 in snout, and 1.5 times the bony interorbital space; mouth large, nearly horizontal, lips broad, maxillary reaching under middle of eye, lower jaw slightly projecting; teeth in both jaws pluriserial, outer row consisting of long, curved, slender caninoid teeth; tongue rounded.

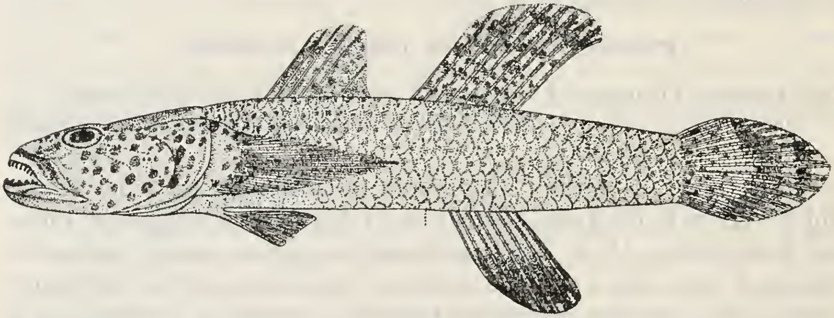


Figure 106.—*Ctenogobius cephalopardus*, new species: Type (U.S.N.M. No. 119580). Drawn by Mrs. Alice C. Mullen.

Squamation: Body covered with ctenoid scales, which are lacking on the breast and on base of pectoral fins; scales in lengthwise series about 31 (excluding small scales on caudal fin), in transverse series from origin of second dorsal to origin of anal 9, predorsal scales 6 or 7, more or less imbedded; circumpeduncular scales 12; head entirely scaleless; on predorsal region some scales extending forward on sides to a point about over midlength of opercle.

Fins: Dorsal rays VI—I, 8, longest spines and rays somewhat more than 0.5 head; caudal fin evenly rounded, 0.7 head; anal fin similar to second dorsal, rays I, 7; ventral disk rather short, circular, about 0.5 length of head, frenum bilobed; pectorals slightly shorter than head.

Coloration: Above yellowish brown, each scale of back, side, and abdomen with a pale reddish brown rounded spot; side of head from under eye to posterior edge of opercle thickly covered with rounded dark brown spots; a narrow dark stripe extending forward from each eye to the base of the upper lip, stripes of the two sides meeting to form a curve at base of upper lip; first dorsal with obscure darkish spots; second dorsal with 6 or 7 oblique rows of dark spots; caudal fin with dark spots forming irregular cross bars; anal fin distally blackish, with a colorless edge; ventrals with rays distally blackish; pectorals pale, with dusky edge, the fleshy base with a cross row of round brown spots.

Type and paratypes.—The type (U.S.N.M. No. 119580) is a female, 5.2 cm. long, including the caudal fin, collected August 14, 1934, by Layang Gaddi, on Doi Hua Mot in Huey Melao, a tributary of the Mekok that flows into the Mekong north of Chiengrai in Northern Thailand. From the same brook and one of its branches, the Huey Len, the same collector, on 5 days in August 1934, took 56 specimens ranging in length from 2 to 5.3 cm. Paratypes are U.S.N.M. Nos. 119581–119586.

Other specimens.—Three specimens, 3.7 to 4.7 cm. long, from the Menam Mao, a branch of the Menam Fang, tributary of the Mekong, were taken by Deignan on December 25. 1936.

Remarks.—This species has been found farther inland than any other Thailand goby. It is very common in the Huey Melao, a typical mountain brooklet, and appears to reach a maximum length of less than 6 cm.

The degree of squamation in the predorsal region varies within narrow limits, and the median scales may be six to nine, with the scales on the sides extending a little farther forward than those on the median line.

In some specimens there is a tendency for the spots on the sides to form into obscure bands, blotches, or saddles, and the spots on the base of the pectoral fins may become diffused or combined into irregular patches or form into a vertical line. In some male specimens there is on the first membrane of the first dorsal a spot that by its size and blackness, stands out a little more distinctly than the other spots on the fin.

Specimens from the Menam Mao are comparatively dark, with the body cross bands, the spots on head, and those on pectoral base very distinct, and the lips fuller and broader, but such characters as squamation and fin rays agree with the less highly colored specimens from the Doi Hua Mot region.

CTENOGOBIUS CYLINDRICEPS Hora

Ctenogobius cylindriceps Hora, 1923a, p. 745, figs. 26–28 (Chilka Lake); 1924a, p. 494 (Tale Sap).

Described in 1923 from numerous specimens from both fresh and salt waters of Chilka Lake, India, this species was found by Hora to be represented by five specimens in a collection made by Annandale in the Tale Sap, Peninsular Thailand, in 1916. A length of 1½ inches is attained in India. A Tale Sap specimen, 16 mm. long, was a female full of eggs, which were very numerous, closely packed together, and 0.5 mm. in longest diameter.

This diminutive species has rather large scales (25 in longitudinal series, 6 in transverse series between second dorsal fin and origin of anal), head entirely alepidous, one or two predorsal scales, outer row of teeth in both jaws canine to caniniform, mucronate tongue, and body marked by 7 to 11 yellow cross bands, with round spots on side of head, and ventral fins nearly wholly black.

CTENOGOBIUS ALCOCKII (Annandale)

Gobius alcockii Annandale, Journ. Proc. Asiatic Soc. Bengal, vol. 2, p. 201, fig. 1, 1906 (Bengal).
Ctenogobius alcocki Hora, 1924a, p. 494 (Tale Sap).

Several adult and young specimens of this species, otherwise known from eastern India, were collected by Dr. Annandale in the Tale Sap, Peninsular Thailand, mostly from the inner lake at the mouth of the Patalung River. The local material has been compared by Dr. Hora with the types from lower Bengal and found to be in general agreement. A length of 16 mm. has been recorded for Indian specimens, while 21 mm. is the maximum for Thailand specimens. A female, 16 mm. long, from the Tale Sap was in spawning condition, the eggs being 0.9 mm. by 1 mm.

The species as described by Annandale was said to have the dorsal formula V–I, 6 or 7, but Dr. Hora found 6 spines in the first dorsal. A further feature, which may prove to be incorrect, is the presence of a large patch of ctenoid scales on the opercle, shown in the figure but not referred to in the text; if this patch of scales is actually present, the species cannot belong in this genus.

CTENOGOBIUS CHIENGMAIENSIS (Fowler)

Rhinogobius chiengmaiensis Fowler, 1934a, p. 157, fig. 126 (Chiengmai).

Described from three specimens, 2.9 to 3.5 cm. long, taken at Chiengmai, in December 1932, this goby is found farther inland than any other local species, except one. Important features are the absence of any scales on the midline of the back anterior to the dorsal fin, and the presence of "simple conic, little curved, minute, uniserial teeth in jaws." As the existence of uniserial teeth is not otherwise known in this genus and is at variance with the generic definition, it is probable that an error has occurred in the description.

CTENOGOBIUS VEXILLIFER (Fowler)

Ctenogobius vexillifer Fowler, 1937, p. 252, fig. 282 (Bangkok).

Known from a single specimen, 4.8 cm. long, from Bangkok, this species has about 27 scales in longitudinal series, 10 minute predorsal scales, very conspicuous rows of papillae on the opercles and cheeks, several dorsal spines prolonged, and strongly contrasting coloration especially of head and fins; body brown, with irregular blackish-brown blotches on back and sides; head with 5 blackish bars under eye and on preopercle and opercle; lower two-thirds of second dorsal blackish brown, margin pale; caudal with 5 or 6 narrow wavy blackish-brown cross stripes and several round white spots at base; anal membranes black; ventrals grayish black with white margin; and pectorals gray, with 2 irregular black basal spots extending on the white fleshy base.

Genus BRACHYGOBIUS Bleeker

Brachygobius Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 315, 1874. (Type, *Gobius doriae* Günther.)

BRACHYGOBIUS SUA (H. M. Smith)

Thaigobiella sua Smith, 1931a, p. 35, fig. 17 (Bangkok).
Brachygobius xanthozona Fowler, 1937, p. 248, figs. 263–277 (Bangkok). (Not *Gobius xanthozona* Bleeker.)
Brachygobius xanthomelas Herre, *in* Herre and Myers, 1937, p. 43, pl. 4 (Singapore and Johore, Malaya).

This fish has been known from Thailand only in canals and tidal ditches in the city of Bangkok. It appears at times in small scattered schools at the surface of the turbid water, where it is recognizable, notwithstanding its small size, by black cross bands on the creamy yellow background of the body. Specimens were collected in January, May, and August, that is, during both the dry and the rainy seasons.

This is one of the most diminutive of the local gobies. It appears to reach full maturity when only 2.7 to 2.8 cm. long. Fish 2 cm. long, taken in May, were females fully distended with eggs.

A fish kept in a small glass jar in Bangkok for a period of six weeks never overcame its shyness, and remained on the bottom concealed among particles of sticky mud or beneath the fibrous roots of a natant water plant.

The original description of the species, from a single specimen 2.7-cm. long, gave only 5 rays in the first dorsal fin. The type is not now available, but from various other specimens in hand it would appear that either an error was made in counting the dorsal spines or that the type was abnormal, and that the correct number is 6. The genus *Thaigobiella*, based largely on this feature, seems therefore to be invalid and becomes a synonym of *Brachygobius*.

Numerous specimens, 1 to 2.8 cm. long, from Bangkok were in the collections made by Mr. de Schauensee. Fowler (1937), describing these specimens in detail, considered them identical with *Brachygobius xanthozona* (Bleeker), made *sua* a synonym of that species, and noted that "the genotype of *Brachygobius* was long made known (1849) as *Gobius xanthozona* Bleeker, from Surabaija, east Java." It may be pointed out, however, that *Brachygobius* dates from 1874 and that its genotype is *Gobius doriae* Günther (1868) from Borneo, as designated by Bleeker in his first description of the genus. Bleeker (1874) made his *Gobius xanthozona* the type of the genus *Hypogymnogobius*, being perhaps influenced by Günther's statement that *Gobius doriae* had cycloid scales. As indicated by Koumans (1931), there is no difference between *Brachygobius* and *Hypogymnogobius* in this respect, and the latter is a synonym.

The number of dorsal spines, namely 5, which Fowler ascribes to his Thailand specimens, is incompatible with *Brachygobius*. Furthermore, Bleeker, Günther, and Koumans have given 50 or about 50 scales in longitudinal series in *xanthozona* as against 26 in the type of *sua* and as stated by Fowler for his specimens of "*xanthozona*" from Bangkok.

An obvious lapsus occurs in Fowler's very useful series of 15 figures of color variation in "*xanthozona*" from Thailand in that the dorsal spines are uniformly represented as 4.

The species described and figured by Herre *in* Herre and Myers (1937) from Singapore and Johore under the name *Brachygobius xanthomelas* appears to be the fish now under consideration. This conclusion is reached after an examination and comparison of the paratypes of *Brachygobius xanthomelas* in the U. S. National Museum.

The presence of scales on the opercles in *Brachygobius* seems variable. In his description of *Gobius doriae*, Günther (1868) mentioned "a few scales on the hind part of the gill-cover," but Bleeker, in his definition of *Brachygobius*, made no reference to the matter, and in his definition of *Hypogymnogobius* specified no scales on the head. In the noteworthy paper by Koumans (1931), *Brachygobius* is defined as having large ctenoid scales on the opercle. Herre (1937) described and figured *Brachygobius xanthomelas* as having no scales on the opercle; and finally it may be noted that while *Brachygobius sua* was originally credited with a scaled opercle, no scales have been found on the opercle in the specimens now in hand.

Genus CRYPTOCENTRUS Ehrenberg

Cryptocentrus EHRENBERG, *in* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 12, p. 111, 1837. (Type, *Cryptocentrus meleagris* Ehrenberg.)

Although the generic name *Cryptocentrus* (hidden spine) has no significance when applied to these gobies, they constitute a fairly well-marked group with six local species, two from the Menam Chao Phya at Bangkok, two from estuarine waters of Southeastern Thailand, and two from rocky islets in the Gulf of Siam. All of these are herein listed in order that the genus may be fully covered, although some of them are outside the strict scope of this work. All the local forms are of large size, compared with most gobies; that is, they are 10 to 17 cm. or more in length, and all are of striking coloration.

Superficial resemblance to *Oxyurichthys* is marked. An outstanding point of difference is the presence of teeth in the upper jaw in a single row in *Oxyurichthys* and in several rows in *Cryptocentrus*.

The species of *Cryptocentrus* included in this catalog have the following differentiating characters:

1*a*. Dorsal rays VI–I, 10 or 11; anal rays I, 9 or 10.
  2*a*. Scales in longitudinal series about 75 to 95.
    3*a*. Caudal fin rounded; body with dark cross bands, of which the 6 posterior are most distinct; dorsal rays with dark spots; caudal with 10 transverse lines of dark spots; anal with about 10 dark bent bars; ventrals dark, with white spots; pectorals with 6 transverse dark bands. maudae
    3*b*. Caudal fin bluntly pointed.
      4*a*. Anterior dorsal spines not produced and shorter than head; predorsal region medianly scaled; body pale brown, with 6 dark brown saddles; 5 oblique dark stripes on side of head behind eye; anal fin with 4 dark longitudinal lines, the outermost forming an edge to the fin; ventrals dark gray, other fins plain____________________ wehrlei
      4*b*. Anterior dorsal spines produced and longer than head in both sexes; predorsal region medianly unscaled; body pale buff, with 8 to 10 dark green or brown vertical or somewhat oblique cross bands extending entire depth of body; a large round dark spot on caudal peduncle; first dorsal fin mostly pale brown, distal part of first 4 membranes pale orange, a large ocellus involving distal part of fourth and fifth membranes and fifth spine consisting of a circular jet-black center and a broad white and blue margin; second dorsal fin with a longitudinal median row of orange spots surrounded by pale yellow; anal fin with a brown margin and a brown longitudinal line near base; caudal fin with pastel tints of brown, blue, and yellow in lengthwise bands; ventrals purplish black; pectorals hyaline_ callopterus
  2*b*. Scales in longitudinal series over 100; all scales cycloid; caudal fin bluntly pointed.
    5*a*. Scales in longitudinal series about 125; body reddish brown, unmarked; head with 8 oblique dark stripes on cheek and opercle; fins mostly plain, anal with 3 dark longitudinal lines_________________ leonis

5*b*. Scales in longitudinal series about 105; body rosy, with 7 or 8 dark cross bands; side of head with irregular rosy or pearly spots surrounded by a narrow dark line; membranes of dorsal fins with a large elliptical ocelli with mauve center surrounded by a narrow white ring and a narrow dark margin; second dorsal and anal fins blackish or dark purplish with a light edge; caudal fin white__________ leptocephalus

1*b*. Dorsal rays VI–I, 19 or 20; anal rays I, 19 or 20; scales in longitudinal series over 100; caudal fin lanceolate; body greenish, with 3 broad rose-colored cross bands; dorsal fins pale green, first red above, second yellow above; with blue and red margins; caudal fin green with many alternating bands of red and blue, its upper edge yellow; anal fin green, with a double median longitudinal band of red and blue; ventrals pale reddish violet; pectorals pale rose____________________________________ gymnocephalus

CRYPTOCENTRUS MAUDAE Fowler

Cryptocentrus maudae FOWLER, 1937, p. 254, fig. 283 (Bangkok).

A strikingly marked fish, known from a single specimen 14.8 cm. long, from Bangkok. Besides dark cross bands most distinct on the posterior half of the body, the dorsal rays are spotted, the caudal has 10 curved cross rows of dark spots, the anal has 8 to 10 bent black bars, and the pectorals have 6 curved transverse dark bands.

All the other local species have a lanceolate or a bluntly pointed caudal fin. The presence in this species of a caudal fin with a rounded posterior edge is at variance with the generic definition of *Cryptocentrus.*

CRYPTOCENTRUS WEHRLEI Fowler

Cryptocentrus wehrlei FOWLER, 1937, p. 256, fig. 284 (Bangkok).

This species is known from a specimen 9 cm. long taken at Bangkok. It somewhat resembles *C. leonis* but differs in such characters as squamation, shape of caudal peduncle, and coloration. The principal differential features are in the scales in longitudinal series (79 against about 125), scales in tranverse series (21 against 30), predorsal scales (22 against 35), depth of caudal peduncle (3.75 against 3 in head), and pale brown coloration of body with about 6 dark brown cross blotches (against plain reddish brown body without any markings). The series of dark, parallel oblique lines on the side of the head behind the eye is common to both forms.

CRYPTOCENTRUS CALLOPTERUS, new species

PLATE 9, *b*

Description.—Elongate, body and head moderately compressed, depth 5 to 5.25 in standard length, depth of caudal peduncle 1.5 in its length and 2.4 in length of head; head blunt, its dorsal profile regularly curved and similar to its ventral profile, 3.6 in standard length; snout gently decurved, shorter than eye and about 4.5 in head; eye reaching dorsal profile of head, 4 in head; eyes very close together, the bony interorbital space about 0.25 diameter of eye; mouth large, oblique, the maxillary extending to a point under posterior edge of eye; teeth pluriserial in both jaws, those in outer row enlarged and distinctly canine; gill openings extending far forward, leaving a narrow isthmus.

Squamation: Body fully scaled to anterior part of dorsal fin, with a few scales extending forward from sides to vertical from gill openings; breast scaled; head and median predorsal area entirely scaleless; scales mostly ctenoid, becoming cycloid and smaller anteriorly; scales in longitudinal series about 78 to 80, in transverse series between second dorsal and anal fins 24 or 25, circumpeduncular scales 26, pectoral base unscaled.

Fins: Dorsal rays VI–I, 10; first dorsal high, its anterior spine produced in a filament longer than eye, next 3 spines of nearly equal length, shorter than head and longer than depth of body, last 2 spines shorter, the last 0.5 length of 4th; second dorsal low, of nearly equal height throughout, about 2 in length of head; caudal broad and acutely pointed, its length equal to head; anal similar to second dorsal, its rays I, 10; ventrals very long, 0.8 head; pectorals about as long as ventrals, their rays 15.

Coloration: Body pale buff, with 8 to 10 dark green or brown vertical or somewhat oblique cross bands of unequal width extending entire depth of body, the first on nape, the last expanded into a large round spot at base of caudal fin; sides of head under and behind eyes with numerous pale orange roundish spots in irregular arrangement; basal part of first dorsal fin pale drab, distal part of first 4 membranes pale orange, an ocellus larger than eye involving outer part of fourth and fifth membranes and fifth spine consisting of a circular jet-black center and a broad ring pale blue distally and white basally; second dorsal fin pale bluish, with a row of elliptical brown spots on basal part of membranes, a median row of pale orange spots surrounded by pale yellow, and a marginal row of pale yellow spots; caudal fin with pastel tints of pale blue, pale yellow, and pale brown in irregular lengthwise bands; anal fin pale yellow and gray, with a pale brown marginal band and a pale brown longitudinal band near base; ventrals purplish black; pectorals hyaline.

Type and other specimens.—The collection of the U. S. National Museum contains six specimens, 6.8 to 9.4 cm. long, from the estuary of the Chantabun River, Southeastern Thailand, in 1926 and 1927, of which a male of 9.3 cm., taken June 14, 1926, is the type (U.S.N.M. No. 119572); paratypes, U.S.N.M. Nos. 119573–119576. Reproduced herewith is a photograph of a water color drawing made from life by Luang Masya Chitrakarn. Other specimens in the National collection are seven, 7.4 to 8.6 cm. long, taken on Koh Pa-ngan, Gulf of Siam, in July 1931, and four, 7.1 to 8.6 cm. long, from the estuary of the Chantabun River in April 1933.

Remarks.—This is a strikingly beautiful fish known to inhabit the Chantabun River and Estuary, the shores of Koh Samui, and coral reefs at Koh Pa-ngan. It will no doubt be found to occur on other parts of the Thai coast.

The species resembles *C. leptocephalus* in general shape and coloration, especially in the dark cross bands on the body, but differs therefrom in having ctenoid scales, larger scales (about 78 to 80 against 105 in longitudinal series), and entirely different coloration and pattern of markings of the head and fins.

CRYPTOCENTRUS LEONIS H. M. Smith

Cryptocentrus leonis SMITH, 1931a, p. 46, fig. 21 (estuary of Chantabun River).

The type, the only known specimen, 13.5 cm. long, was taken in the Chantabun Estuary at Lem Sing (Lion Point), in July 1928. The peculiar physiognomy, with the eye in the anterior third of the head and portruding above the dorsal profile like a *Periophthalmus*, together with the uniform reddish brown color of the body and 8 oblique dark brown stripes on the cheeks and opercles, makes the recognition of this species easy. In *C. wehrlei*, which bears some resemblance to *C. leonis*, there are 5 oblique dark stripes on the side of the head and the body is marked by dark cross bands.

CRYPTOCENTRUS LEPTOCEPHALUS Bleeker

FIGURE 107

Cryptocentrus leptocephalus BLEEKER, 1876 (469), p. 146 (Singapore).

Described by Bleeker in 1876 from a single specimen, 8.3 cm. long, collected at Singapore, this species has rarely been mentioned in publications since that time. It is a form with several striking features, including minute scales, which are cycloid throughout (a condition not found in other local species), and peculiar coloration, consisting of a

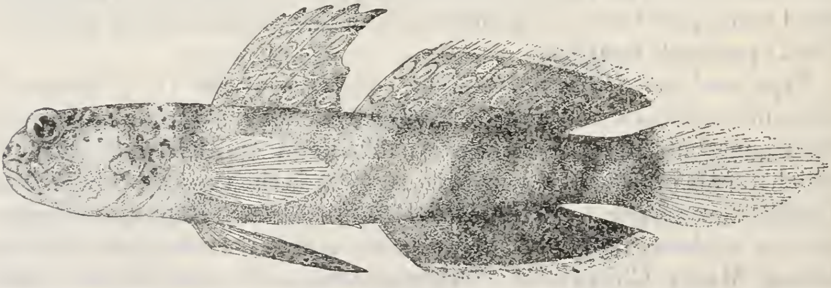


FIGURE 107.—*Cryptocentrus leptocephalus* Bleeker. Drawn by Luang Masya; courtesy of the Thailand Government.

rosy body with 7 or 8 dark somewhat oblique transverse bands, with large, irregularly shaped and disposed ocelluslike rosy or pearly spots, surrounded by a very narrow dark line, and on the membranes of both dorsal fins numerous elliptical ocelli consisting of a mauve center, a narrow white ring, and a still narrower dark outer line.

The Thailand records for this species are seven specimens now in the U. S. National Museum, 7.6 to 9.9 cm. long, taken in the Gulf of Siam at Koh Kahten in May 1931, and six at Koh Pa-ngan in July 1931. The fish has been found also at Koh Samui, in the same section of the Gulf of Siam. A specimen from Koh Pa-ngan, examined at the Royal Natural History Museum in Leiden by Dr. F. P. Koumans, was pronounced by him as agreeing with Bleeker's type.

CRYPTOCENTRUS GYMNOCEPHALUS (Bleeker)

Gobius gymnocephalus BLEEKER, 1853 (78), p. 473 (Batavia).
Cryptocentrus gymnocephalus SMITH, 1933a, p. 82 (Koh Sichang).

Described from two specimens, 11.7 and 14 cm. long, from Batavia, Java, this species seems to have been encountered infrequently. Bleeker's voluminous writings contain a single subsequent reference to the occurrence of the fish, at Hong Kong (1873 [425], p. 128).

One specimen 12.1 cm. long was taken at Koh Sichang in June 1929. It was compared by Dr. Koumans with Bleeker's types in the Royal Natural History Museum in Leiden and found to be in agreement.

Family PERIOPHTHALMIDAE: Mudskippers

These gobies are familiar creatures on mud flats throughout tropical and temperate seas of the Oriental region and Oceania. The pectoral fins, with elongated and well-developed muscular base, are used for locomotion out of water and they enable the fishes to move rapidly and to make surprising leaps. The large eyes, placed very close together at the top of the head, are on short stalks and may be elevated for making observation and withdrawn flush with the surface.

The family as herein considered comprises the closely related genera *Periophthalmus* and *Periophthalmodon*, both represented in Thailand. Some authors place in this family the genera *Boleophthalmus* and *Scartelaos* which, in the present catalog, are assigned to another family on the basis of horizontal teeth in the lower jaw, fully united ventral fins at all stages of growth, short first dorsal fin, very long second dorsal and anal fins, and other characters.

The two Thailand genera may be differentiated as follows:

1*a*. Spines in first dorsal fin 10 to 15; ventral fins united only at base; teeth in both jaws in a single row; scales ctenoid, minute, 75 to 100 in lengthwise series____ Periophthalmus

1*b*. Spines in first dorsal fin 0 to 15; ventral fins usually completely united and in fundibular form, partly united in young; teeth in upper jaw in 2 rows; scales cycloid, larger, 48 to 60 in lengthwise series____Periophthalmodon

Genus PERIOPHTHALMUS Bloch

Periophthalmus BLOCH, *in* Schneider, Systema ichthyologiae, p. 63, 1801. (Type, *Periophthalmus papilio* Bloch.)

PERIOPHTHALMUS BARBARUS (Linnaeus)

Gobius barbarus LINNAEUS, 1766, p. 450 (locality not given).

Periophthalmus koelreuteri SAUVAGE, 1883b, p. 151 (Menam Chao Phya).—JOHNSTONE, 1903, p. 295 (Patani, Jhering).—HORA, 1924a, p. 495 (Tale Sap).

Periophthalmus barbarus FOWLER, 1935a, p. 163 (Paknam).

This species has a very wide distribution: Japan to China, Philippines, Indo-China, Thailand, Malaya, and India, and thence to South Pacific and East Indian islands, West Africa, and Australia. It is for the most part an inhabitant of the muddy, sandy, and rocky shores of bays and estuaries, and of the lower courses of rivers within the influence of the tides. Occasionally in Thailand it is observed in parts of rivers or in canals that are nearly or quite fresh.

The fish is abundant in all the coastwise districts of the country, and renders itself conspicuous by regularly coming out of the water and displaying remarkable activity in the air. Dr. Herre (1927, p. 316) has given this excellent account:

> This extraordinary creature has excited curiosity from time immemorial. Its strange habits, so unfishlike, its astonishing acrobatic feats of agility, its ability to send its eyes aloft and keep one fixed on the human observer while the other rotates on its conning tower and scans the countryside for prey or foe, its enterprise in leaving the water and capturing its crustacean and insect food on land, its habit of leaping along the surface of the water and then taking refuge on land instead of at the bottom of a pool—all these and many other singular traits have caused it to be observed and studied by the ordinary tourist as well as by the fisherman and naturalist.

In July 1923 the writer made the following note on these gobies as observed in the Tachin River at Tachalom where, at low tide, a broad bank of soft mud was exposed: The fishes, mostly 10 to 12 cm. long, were very abundant on the mud flat; a few were as thick as a man's wrist and about 30 cm. long. From 15 to 20 were in sight at one time, and were observed at short range from the launch or from an inclined plank walk extending from the water's edge to houses at the top of the bank. As the gobies emerged from the water and wriggled onto the soft mud, they moved their head from side to side as though sniffing. Many of them paired off and engaged in a comical head-on mock fight, playfully biting at each other and advancing or retreating a few inches at a time, their mouths and eyes filled with soft mud. This may have been a courting exhibition. In the mud near the wooden walk there were a number of large circular holes into which the gobies plunged when frightened. One of the largest ever to come under the writer's observation went into a hole directly under the walk. Some bright copper coins were displayed and a naked half-grown boy was induced to go after the fish. When half an hour later the writer returned from a visit to the local market, the boy was up to his neck in the hole and was still throwing out mud, but he never reached the fish. Many of the houses on the river's edge had small bamboo traps and the principal catch consisted of gobies of this species which, needless to state, were eaten by the inhabitants.

The fish shares with *Periophthalmodon schlosseri* the vernacular name *pla tin.*

Genus PERIOPHTHALMODON Bleeker

Periophthalmodon Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 326, 1874. (Type, *Periophthalmus schlosseri* Valenciennes.)

PERIOPHTHALMODON SCHLOSSERI (Pallas)

Gobius schlosseri Pallas, 1770, pt. 8, p. 5, pl. 1, figs. 1–4 (locality not given).

Periophthalmus borneensis Bleeker, 1865 (347), p. 34 (Siam).—Bleeker, 1865 (356), p. 174 (Siam).

Periophthalmus schlosseri Bleeker, 1865 (356), p. 175 (Siam).—von Martens, 1876, p. 392 (Siam).—Károli, 1882, p. 166 (Bangkok).—Sauvage, 1883b, p. 151 (Menam Chao Phya).—Hora, 1923b, p. 179 (Bangkok).

Periophthalmus phya Johnstone, 1903, p. 296, pl. 14, fig. 1 (Patani and Jambu Rivers, Malay Peninsula).

The range of this species is from the East coast of India to the Philippines and the East Indies, including Burma, Thailand, and Malaya. It is found on muddy shores in bays, estuaries, rivers, and canals, and in Thailand it goes well upstream into strictly fresh water.

The largest examples met with in Thailand were 25 cm. long. Many were seen up to 20 or 21 cm.

Great variation in dorsal spines, squamation, and coloration is met with in this species. The number of dorsal spines varies from none to XV; that is, the first dorsal fin may be entirely absent, and a dozen nominal species have been based on this variable feature.

Günther (1861, vol. 3, pp. 100, 101) noted specimens from Thailand in the Mouhot collection with 4 or 5 dorsal spines (*P. freycineti* Cuvier and Valenciennes) and with 13 to 15 dorsal spines (*P. tredecimradiatus* Hamilton), both lots apparently taken together, according to Günther.

A common size on the banks of canals and rivers exposed at low tide is 6 to 8 cm. long. Such fish find shelter in holes about the diameter of one's thumb in stiff mud. Rapid movement on the mud, as in fright, is effected by the flipping of the tail, but for ordinary movement they depend on their pectoral fins, which are moved in unison, like oars in rowing a boat. They make a characteristic trail on the mud: a central streak where the body drags and pairs of depressions on either side where the pectoral fins are inserted. They are somewhat clumsy on banks with even a moderate slope and often roll over on their backs but quickly right themselves.

By far the best account of the habits of this fish has been given by Johnstone and is attributable to Annandale and Robinson; the following excerpts are from that account:

> The adults are very abundant in the immediate vicinity of the town of Jambu, where a large area of semi-liquid mud is exposed at low tide, but their wariness renders them difficult of approach, especially at half-tide, when they do not appear to have settled down to a terrestrial existence. They seem to be very sensitive to cold or fog, and do not come out on the mud-flats early in the morning, even at low tide. When the sun is well up, however, they skip about many yards away from any water, and quite careless as to whether their tail or any other part of their body can be kept wet, even when the temperature is so high that sand becomes too hot for a European to walk upon it with bare feet. * * *
>
> A most important feature in which the habits of the present form differ from those of its congeners is that it constructs a more or less permanent burrow, in which it takes refuge when alarmed and remains in bad weather. Whether this burrow is also used as a nest we cannot be sure, but it appears to be frequented by individuals of both sexes, and the natives say that the female deposits her eggs in smaller holes made for the purpose. The main entrance to the large burrows is always more or less funnel-shaped and slanting, and lies in an oval or circular pool of water, which is retained round it as the tide sinks—for it is always made between tide-marks—by a rampart of mud four to six inches in height, and about a foot and a half in diameter. It is surrounded, outside the rampart, by a number of simple holes, which probably lead into the central shaft, though, owing to the liquid condition of the mud, we were unable to demonstrate this by digging. When thoroughly alarmed, the fish sometimes enters one of these holes, but if only a little scared, it rushes to the rampart, surmounts it, and sits for a longer or shorter period on it before diving into the pool and disappearing. It seemed quite evident to us that each individual had its proper burrow, but how many inhabited one burrow we could not ascertain, it appeared that their number must be small. The central pool was always entered at one point, so that a definite furrow was made on the rampart, and the characteristic tracks of the fish—consisting of a central line (made by the tail) and two series, running parallel to one another on either side of the line, of more or less hand-shaped depressions (made by the tips of the more prominent pelvic rays and the web between them)—converged towards it, showing readily whether the fish had recently gone out or in.
>
> At first we were much puzzled as to how the rampart and burrow were made, but the natives told us that the fish wriggled down into the mud, filled its mouth with the stiffer clay beneath the surface, and built up the wall with pellets thus brought from below. We found it impossible to confirm their statement by actual observations, but there is every reason, in this case, to regard them as accurate observers, for the colour of the walls plainly showed that they were not made of surface mud, while the shape and size of the pellets, which could easily be distinguished in freshly constructed specimens, were just what would have been expected had they been casts of the inside of the mouth

of an adult of *P. phya*. * * * One of us watched a large individual repairing its rampart, which had been injured by the tide, for some time, but could not be sure exactly how this was accomplished; the fish certainly went down the central hole and returned in a few seconds, bringing a pellet of mud with it.

The eyesight of this species appears to be keen, both in air and water, and to range in the former element for a radius of at least thirty feet. We noticed repeatedly that when we had frightened an individual into its burrow, it remained concealed as long as we stayed still, but reappeared as soon as we began to move away; and this would seem to indicate that the fish could see from beneath the surface of the water what was going on in the air. On land, at any rate, it is absolutely deaf, and Robinson found, when shooting specimens, that those which were not hit took no notice whatsoever of the report of the gun, and only moved when the shot spattered them with mud.

The fish called *Periophthalmus phya*, described by Johnstone (1903) from the Patani River in the Peninsula and the Jambu River in Malaya, seems to be the present species. Johnstone observed that it "resembles *P. schlosseri*, but appears to differ in (1) the complete fusion of the pelvic fins in both young and adult specimens; (2) the number of rays in the pectoral fins; (3) the number of rays in the caudal fin, and (4) the larger size of the specimens obtained." The size at which the ventral fins become completely joined together varies with individuals and can hardly be regarded as of specific significance, although it should be stated that the three specimens, 2 to 2⅛ inches long, in which Johnstone found the ventrals completely fused are smaller than any that have been found by the present writer to possess this feature. Ordinarily the complete union of the innermost rays by a membrane may not be expected under 12 cm. (4.50 to 4.75 inches), and the smallest specimen in the U. S. National Museum in which the ventrals are fully joined by their inner edges is 12.5 cm. long, including caudal fin. As regards pectoral rays, specified as 16 to 18 in *P. phya*, this number does not seem unusual in *P. schlosseri;* specimens in a lot of the latter from Borneo in the National collection have 17 pectoral rays. Likewise, the number of caudal rays in *phya*, namely 17 to 23, is matched by 18 to 20 rays in Bornean specimens of typical *schlosseri*.

The colloquial name for this fish in Thailand is *pla tin*. A name heard on the Menam Chao Phya below Bangkok is *pla kajang*.

Family APOCRYPTEIDAE: Apocrypteid Gobies

The genera herein placed in this family group have been variously classified and allocated by authors. Bleeker (1874 [453]) placed them in a phalanx (Apocrypteini) of his subfamily Gobiiformes and divided them into two subphalanges, one (Apocryptei) containing *Apocryp-*

ies, *Apocryptodon*, *Parapocryptes*, and *Pseudapocryptes*, the other (Boleophthalmi) comprising *Boleophthalmus* and *Scartelaos*. Jordan (1923) placed *Boleophthalmus* and *Scartelaos* in the family Periophthalmidae and left the other genera in the Gobiidae, a course followed by Herre (1927, p. 322). Koumans (1931, p. 128), guided no doubt by Bleeker, made the subfamily Apocrypteinae for the reception of all of the genera herein considered, and left the subfamily Periophthalminae for the two genera herein placed in the Periophthalmidae.

It is not a matter of great importance just what assignments and groupings of these genera are proposed. For present purposes, and in the opinion of the present writer, the relationships of the fishes are perhaps best indicated by putting them in a separate family. The distinguishing characters of the genera are as follows:

1*a*. No free lower eyelid; eyes scarcely or not at all erectile above the dorsal profile of the head (subfamily Apocrypteinae).
  2*a*. Scales very minute, more than 200 in longitudinal series; teeth in both jaws pointed; a pair of canine teeth behind symphysis of lower jaw; second dorsal fin with 28 to 31 rays................ **Pseudapocryptes**
  2*b*. Scales larger, about 100 or less in longitudinal series.
    3*a*. Teeth in lower jaw pointed; anterior teeth in upper jaw caniniform; a pair of canine teeth behind symphysis of lower jaw; about 80 scales in longitudinal series................................ **Parapocryptes**
    3*b*. Teeth in lower jaw truncate, obtuse, or bilobate.
      4*a*. A pair of canine teeth behind symphysis of lower jaw; teeth in lower jaw truncate or bilobate. Anterior teeth of upper jaw caniniform; scales in longitudinal series 40 to 60; second dorsal fin with 23 or 24 rays.................................... **Apocryptodon**
      4*b*. No canine teeth behind symphysis of lower jaw; teeth in lower jaw obtuse; anterior teeth in upper jaw strongly canine; scales in longitudinal series 70 to 90; second dorsal fin with 24 to 27 rays. **Apocryptichthys**
1*b*. A free lower eyelid; eyes erectile above the dorsal profile of the head (subfamily Boleophthalminae).
      5*a*. Teeth in lower jaw subhorizontal, flattened, and obliquely notched; tongue truncate; scales (in local species) in longitudinal series about 70 to 100 or somewhat more; no barbels on lower jaw; second dorsal fin with 23 to 25 rays; dorsal and anal fin not united to caudal fin.......................... **Boleophthalmus**
      5*b*. Teeth in lower jaw pointed, subhorizontal anteriorly, more erect posteriorly; tongue rounded; scales minute, more or less rudimentary, somewhat larger posteriorly, often altogether absent on head and anterior part of body; a barbel on chin and a series of small barbels on the upper lip and on the ramus of the lower jaw; second dorsal fin with 25 to 29 rays; dorsal and anal fins joined to base of caudal fin by a membrane................ **Scartelaos**

Genus PSEUDAPOCRYPTES Bleeker

Pseudapocryptes BLEEKER (453), Arch Néerl. Sci. Nat. vol. 9, p. 328, 1874. (Type, *Apocryptes lanceolatus* Cantor.)

PSEUDAPOCRYPTES LANCEOLATUS (Bloch)

Eleotris lanceolata Bloch, *in* Schneider, 1801, p. 67, pl. 15 (Tranquebar).
Apocryptes lanceolatus Bleeker, 1865 (347), p. 34 (Siam); 1865 (356), p. 174 (Siam).—Johnstone, 1903, p. 295 (Patani River).

This species ranges from India to Thailand, Malaya, and the Indo-Australian Archipelago. It is uncommon, or at any rate rarely recognized, locally. In addition to the records shown in the synonymy, several specimens in the British Museum from the Menam Chao Phya were received from the Siamese Museum.

A length of more than 20 cm. is attained.

Two specimens taken in the Menam Chao Phya at Paknam, February 5, 1927, 21.5 and 24 cm. long, have the very long slender interlocking teeth in both jaws slightly dilated at the tip, with a dull point.

The following interesting account of this species, as observed by Annandale and Robinson in the Patani River, is given by Johnstone (1903):

> This is the least terrestrial of the mud gobies which we saw in Malaya, and is obviously less highly specialized for an amphibious life than any species of *Boleophthalmus* or *Periophthalmus*; but it frequently wriggles along the mud some yards away from the water, and its powers of "walking," or rather hopping, on land, though less well-developed than those of its allies, are by no means absent. At the mouth of the Patani River, at dead low tide, numerous individuals line the water's edge, and by some muscular effort raise their heads and bodies into the air almost vertically, remaining poised, as if standing upright on their tails for an instant, and then falling prone on the liquid mud. This curious manoeuvre, probably executed in attempts to capture flies, causes a peculiar sound, which can be heard all along the shore.

This fish is called *pla kua* at Bangkok and Paknam.

Genus PARAPOCRYPTES Bleeker

Parapocryptes Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 327, 1874. (Type, *Apocryptes macrolepis* Bleeker.)

PARAPOCRYPTES SERPERASTER (Richardson)

Apocryptes serperaster Richardson, 1846, p. 206 (Macao, China).—Hora, 1923b, p. 179 (Nontaburi).

This fish of the seas and estuaries of India and China was first made known by Hora (1923b) as an inhabitant of Thailand from three specimens from the Menam Chao Phya at Nontaburi. In 1923 and 1929 the writer preserved specimens from the same river at Pakret and Paknam, and in 1928 and 1933 he took many specimens in the Bangpakong River as far up as Petrieu. A specimen, 21.2 cm. long, obtained near Petrieu on June 27, 1933, was a ripe male, and had the following colors while alive: Body grayish green, with 5 dark green blotches meeting across the back and 4 dark green spots along the side; belly pale salmon; underside of head pale yellow; dorsal fin hyaline, with some vague dark green lines at base; caudal fin green, its lower edge bright yellow; anal fin salmon anteriorly, basal part of posterior two-thirds greenish; ventral fins salmon; pectoral fins brownish, with a bright yellow edge.

The vernacular name on the Menam Chao Phya and Menam Bangpakong is *pla keua.*

Genus APOCRYPTODON Bleeker

Apocryptodon Bleeker (453), Arch. Néerl. Sci. Nat., vol. 9, p. 327, 1874. (Type, *Apocryptes madurensis* Bleeker.)

The gobies of this genus are mostly marine but some species wander into fresh water. The elongate body is nearly cylindrical, finely scaled, and of plain coloration. The horizontal mouth is large, extending beyond a vertical from the posterior border of the eyes, and the single row of widely spaced teeth in each jaw is supplemented by a postsymphyseal pair on the mandible. Three species are ascribed to Thailand, as follows:

1*a*. Scales in longitudinal series 50 to 60, in transverse series between second dorsal and anal fins 13, in predorsal region 26 to 30.
  2*a*. Cheeks scaled to point under anterior part of eye; body marked with 5 or 6 light brown cross bands, which may meet over back; pectorals dark olive or blackish, with a white lower edge ____________ bleekeri
  2*b*. Cheeks scaled only on upper posterior part; body marked with 6 round dark brown spots along middle of side alternating with 5 vertically elongate dark brown spots extending downward from midline of back; head and body with numerous small round black spots; pectorals greenish, with a black lower edge ____________ malcolmi
1*b*. Scales in longitudinal series 165, in transverse series between second dorsal and anal fins 35, in predorsal region 60; head largely covered with very small scales; gray-brown above, white below, large blackish gray blotches on caudal peduncle, caudal fin with 16 or 17 fine, wavy, transverse blackish lines ____________ edwardi

APOCRYPTODON BLEEKERI (Day)

Apocryptes bleekeri Day, 1876, vol. 1, p. 300, pl. 64, fig. 3 (Seas of India, Malay Archipelago).
Apocryptodon bleekeri Fowler, 1939, p. 53 (Krabi).

This species, described by Day from India, is reported by him to range thence to the Malay Archipelago. Its claim to a place in this catalog rests on the record by Fowler of 48 specimens, 16.5 to 23 cm. long, from Krabi (Ghirbi) on the western side of Peninsular Thailand, taken in September 1936.

APOCRYPTODON MALCOLMI H. M. Smith

Apocryptodon malcolmi SMITH, 1931a, p. 47, fig. 22 (Chantabun River).—FOWLER, 1937, p. 257 (Bangkok, Tachin).

Boleophthalmus smithi FOWLER, 1934a, p. 160, fig. 129 (Bangkok); 1935a, p. 162 (Bangkok, Paknam).

Originally known from the Chantabun River and later found in brackish water in the Chantabun Estuary, this species was more recently reported by Fowler from numerous specimens from the Menam Chao Phya at Bangkok and Paknam and several from the Tachin. The type, 7.5 cm. long, is a fully developed female.

A length exceeding 20 cm. is attained by Bangkok specimens.

APOCRYPTODON EDWARDI Fowler

Boleophthalmus taylori FOWLER, 1934a, p. 159, fig. 128; Bangkok; 1935a, p. 162 (Bangkok, Paknam).

Apocryptodon edwardi FOWLER, 1937, p. 257 (Tachin, Bangkok). (Correction of generic identification and substitution of new specific name for *taylori*, preoccupied.)

Described from the Menam Chao Phya at Bangkok and later recorded from Paknam and Tachin, this species is noteworthy for having extremely small scales on head and body (165 in longitudinal series and 35 in transverse series, with 60 in the median line anterior to the dorsal fin), a single row of widely spaced blunt teeth in each jaw with a pair behind the mandibular symphysis, a free lower eyelid, and a very striking pattern of coloration of the caudal fin: 16 or 17 narrow, distinct, wavy, curved dark cross bands. The five specimens recorded by Fowler ranged from 17 to 23.2 cm. in total length.

Even with information supplied in a letter by Mr. Fowler additional to that contained in the published descriptions, it is not possible to make a wholly satisfactory generic allocation of this species chiefly because of the teeth, which in the upper jaw are normally conical with the anterior ones caniniform and in the lower jaw are flattened, subhorizontal, and obliquely truncate, notched, or bilobed.

Genus APOCRYPTICHTHYS Day

Apocryptichthys DAY, Fishes of India, vol. 1, p. 302, 1876. (Type, *Apocryptichthys cantoris* Day.)

The fishes of this genus are few as to species and of small size, apparently not reaching a length of 10 cm. The type species, *A. cantoris* (Day, 1870b, p. 693) remained unique until 1927, when Herre described a new species from China, and in 1935 Fowler named a new species from Thailand. The two forms reported from Thailand, *A. cantoris* and *A. livingstoni*, may prove to be identical. The former has been found in the Gulf of Siam off the mouth of the Meklong, the latter was described from the lower Menam Chao Phya. The apparent differentiating characters are as follows:

1*a*. Dorsal fins described and figured as entirely separated; head scaled above posterior to eyes and on opercle and preopercle; scales in longitudinal series 70 to 90; first dorsal fin with dark longitudinal bars______ **cantoris**
1*b*. Dorsal fins completely united by a membrane; head naked; scales in longitudinal series about 55; first dorsal fin without bars__________ **livingstoni**

APOCRYPTICHTHYS CANTORIS Day

Apocryptichthys cantoris Day, 1876, vol. 1, p. 302, pl. 57, fig. 7 (Madras, Andamans).—Smith, 1931d, p. 189 (Gulf of Siam off the Meklong).

Described from the east coast of India and the Andaman Islands, this fish was first discovered in other waters in 1923 when three specimens, 7.5 to 8.3 cm. long, were taken in a shore seine in the Gulf of Siam near the mouth of the Meklong when a large volume of fresh water was pouring into the gulf.

Although Day described the fish as having the head scaleless, Koumans (1931), having examined Day's type, determined that it had scales on the top of the head posterior to the eyes and also on the opercles and preopercles. Day furthermore described and figured the dorsal fins as entirely separated, but whether this was a natural feature or was due to mutilation is not known definitely; in the other species herein listed and in Herre's new species from China the dorsal fins are united by a membrane having the full depth of the adjoining rays.

APOCRYPTICHTHYS LIVINGSTONI Fowler

Apocryptichthys livingstoni Fowler, 1935a, p. 162, figs. 131, 132 (Paknam).

This fish is known from three specimens, 9.3 and 9.4 cm. long, taken in the Menam Chao Phya at Paknam. It was separated specifically from *A. cantoris* by having the dorsal fins fully united, only about 53 or 54 scales in longitudinal series, and different coloration of the dorsal and caudal fins. The enumeration of the scales in the longitudinal series, however, did not take into account the large number of small or rudimentary scales anteriorly, which scales were counted by Day in his description of *cantoris*. Other apparent differences—squamation of the head, coloration of fins, and similar characters—may justify the retention of this species pending the examination of further material than is now available.

Genus BOLEOPHTHALMUS Cuvier and Valenciennes

Boleophthalmus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 12, p. 198, 1837. (Type, *Boleophthalmus boddaerti* (Cuvier and Valenciennes) = *Gobius boddarti* Pallas.)

The availability of the name *Boleophthalmus* is in some doubt. It may have to be suppressed as a synonym of *Apocryptes*. For the present it may be retained as likely to cause less confusion.

These gobies of curious aspect and habit frequent coastal waters and fresh waters near the sea, and may be recognized by their elongate shape, finely scaled body and head, teeth in jaws in a single row, those in upper jaw conical, those in lower jaw flattened, notched and horizontal, a pair of curved canine teeth behind symphysis of lower jaw, eyes erectile, a distinct lower eyelid, dorsal fins well separated, with the spinous rays produced and much longer than the branched rays, and caudal fin lanceolate.

Two species are recognized from Thailand as follows:

1*a*. Series of scales between posterior end of second dorsal fin and anal fin 8 to 11; body with 7 dark oblique cross bands and small oblique cross bands and small opaque blue spots; caudal fin blackish; pectoral fins either orange with a black edge or black with an orange edge---------------- boddarti

1*b*. Series of scales between posterior end of second dorsal fin and anal fin 17; body dark gray to brown, with irregularly disposed verdigris spots; dorsal fins with blue spots; caudal fin with blue spots between rays; pectoral fins plain-- pectinirostris

BOLEOPHTHALMUS BODDARTI (Pallas)

Gobius boddarti PALLAS, 1770, vol. 8, p. 11, pl. 2, figs. 4, 5 (Indian Ocean).

Boleophthalmus boddaerti JOHNSTONE, 1903, p. 300 (Patani States, Peninsular Siam; Jambu, Malay States).—PEARSE, 1933, p. 174 (Paknam).—FOWLER, 1934a, p. 159 (Bangkok); 1935a, p. 162 (Bangkok, Paknam).

From Thailand this fish ranges through Malaya and the East Indies to India. In Thailand it is found in salt, brackish, and fresh waters, but does not ascend streams beyond tidal influence. It is particularly abundant in large rivers near their mouths, and is often caught in large quantities in pongpang bag nets, which operate on the outgoing tide or current and catch fish swimming down stream. Numerous specimens from the Menam Chao Phya and Menam Bangpakong in Central Thailand and the Menam Chao in Southeastern Thailand have been examined.

Examples up to 15 cm. long are met with in Thailand, and a somewhat larger size is probably attained.

The fish is caught in seines, bag nets, and traps. It is eaten locally and it is also sent to the larger market towns for sale. Sometimes many thousands may reach the Bangkok market from the lower river in a single day.

In his studies of gobies at Paknam, Pearse (1933) found that the long-intestined *Boleophthalmus* (ratio of length of body to length of intestine 1 to 1.45) is almost exclusively vegetarian, the percentage by bulk of its intestinal contents being 83.8 filamentous algae and 12.5

diatoms. The note on this species by Annandale and Robinson appearing in Johnstone (1903) may be abridged as follows:

> The species of this genus [that is, *B. boddaerti*, *pectinirostris*, and *viridis*] do not differ from one another to any great extent in habits. The present form * * * hops about like *P. phya*, in the hottest sunshine, and appears to make a permanent burrow, which, however, is of a very simple nature, devoid of a surrounding rampart. When alarmed it frequently wriggles, tail foremost, into the mud, and this would seem to be the way in which its holes are commenced. Its food * * * is largely of a vegetable nature, and we have watched it browsing on a minute green alga that closely covers the surface of the mudflats at certain points. Unlike *P. phya*, it carries its dorsal fin rays elevated in the air. This gives it a very distinctive appearance as the web of the fin is dotted with conspicuous blue spots. Possibly the fin aids it in its terrestrial progress, like the sail of an ice-boat, as the rays are lowered so as to lie prone whenever it passes through a pool of water even too shallow to wet its dorsal surface; in such conditions a sail might cause it to topple over. The adults are very pugnacious, and if two individuals happen to meet face to face, a hostile demonstration always takes place; they rush together, raising and depressing their dorsal fins with great rapidity, but do not appear to injure one another in any way, and soon part and continue their course.
>
> The chief vertebrate enemies of the "walking" fish in the Patani States are fishing hawks, monitor lizards, and possibly others.

In Patani, as recorded by Annandale, the flesh of this fish is sometimes eaten raw, being considered a powerful tonic or aphrodisiac, which probably accounts for the fish's extraordinary vigor in an element so uncongenial to its class.

In addition to bearing the general name of *pla tin*, which is shared with gobies of this type, this species is called *pla chum pruad* or *pla tum pruad* on the Menam Chao Phya and *pla keua* in Southeastern Thailand. In the Bangpakong a name sometimes heard is *pla kampud*, said to be of Cambodian origin.

BOLEOPHTHALMUS PECTINIROSTRIS (Linnaeus)

Gobius pectinirostris LINNAEUS, 1758, p. 264 (China).

Boleophthalmus pectinirostris SAUVAGE, 1883b, p. 151 (Menam Chao Phya).—JOHNSTONE, 1903, p. 300 (Patani).—FOWLER, 1938, p. 213 (Patani [after Johnstone]).

The local records for this goby, whose range extends from Japan and China to Malaya, the East Indies, and Burma, are those of Sauvage (1883b), who reported the fish from the Menam Chao Phya, and Johnstone (1903) who listed it from Patani.

A length of at least 11 cm. is attained.

Genus SCARTELAOS Swainson

Scartelaos SWAINSON, Natural history . . . of fishes, vol. 2, pp. 183, 279, 1839. (Type, *Gobius viridis* Hamilton.)

The genus *Scartelaos* is close to *Boleophthalmus* but may be recognized readily by the dentition, as given in the key.

SCARTELAOS VIRIDIS (Hamilton)

Gobius viridis Hamilton, 1822, p. 42, pl. 32, fig. 12 (Ganges).
Boleophthalmus viridis Johnstone, 1903, p. 300 (Patani).
Scartelaos viridis Smith, 1931d, p. 190 (Southeastern Siam).—Fowler, 1935a, p. 162 (Bangkok).

Originally described from the Ganges, this fish has been found to range from Eastern India to Malaya and China and to the East Indies and Philippines. It is essentially a salt or brackish water form, but may push up coastal streams into water that is nearly or quite fresh. The fish is rare in Thailand waters. It was first taken in a tidal ditch within the Chantabun Estuary at Lem Sing in March 1930; the single specimen was 6.1 cm. long. A second specimen, recorded by Fowler from Bangkok, was 11 cm. long.

Family GOBIOIDIDAE: Eellike Gobies

Applying the principle of priority to the creation of family names, as is done with generic and specific names, one may recognize the family Gobioididae as established by Jordan (1923) rather than Taenioididae as set up by Hora (1924a, p. 496) even though the name *Taenioides* Lacepède has page priority over *Gobioides* Lacepède. Although the International Rules of Zoological Nomenclature (Article 4) provide that a family name is formed by adding the ending *idae* to the stem of the name of the type genus, they leave the term "type genus" undefined. The implication is that the person creating a new family name may base it on the oldest valid generic name or on some other generic name chosen without regard to priority. Hora's action was no doubt influenced by his contention, based in part on the conclusions of Weber (1913, p. 485), that *Gobioides* is not generically distinct from *Taenioides* and is a synonym thereof. As to this point there is room for difference of opinion. *Gobioides* is an American genus, the type, *broussonetii* Lacepède, ranging from the Gulf of Mexico to Brazil. Among the distinguishing characters of the genus are much fewer dorsal and anal branched rays (15 to 17 as against 32 to 49 in *Taenioides*) than in any species of the Oriental genus *Taenioides*, and the absence of the mental and mandibular barbels supposed to be always present in *Taenioides*. Furthermore, there may be differences in the dentition that would be brought out in a critical examination of more adequate material than is now available. Koumans (1931) said: "I think, the genera *Taenioides* and *Gobioides* are distinct enough to keep them separated, differing e. g. in number of dorsal and anal rays, in placing of teeth and, so far as I know, in presence or absence of barbels."

In Hora's noteworthy paper, all the very elongate, compressed, Oriental gobies characterized by long dorsal and anal fins fully united to or closely contiguous to the caudal fin, ventral fins either completely united to form a disk or wholly or partly separated, minute eyes, absent or more or less rudimentary scales, and very oblique mouth, are placed in the Taenioididae, with two subfamilies recognized, the Taenioidinae and the Trypaucheninae, the latter given full family rank by Jordan (1923), Herre (1927), and others. The separation of these subfamilies is based largely on the possession by the Trypaucheninae of a pouchlike cavity over each opercle, the cavity being lacking in the Taenioidinae.

The locally represented genera number 5 and may be identified as follows:

1*a*. No pouchlike cavity over each opercle (TAENIODINAE).
  2*a*. Barbels present on tip of lower jaw; outer row of teeth in both jaws recurved canines; branched dorsal rays 38 to 52; branched anal rays 37 to 49 .... **Taenioides**
  2*b*. Barbels absent on lower jaw; branched dorsal rays 29 to 32; branched anal rays 27 to 35.
    3*a*. Mouth large, moderately oblique, chin not heavy and dilated; teeth in upper jaw in 2 rows, in lower jaw in 2 or more rows, the outer row enlarged, long, pointed, inward-curved; dorsal fin with 6 or 7 simple rays. **Brachyamblyopus**
    3*b*. Mouth small, very oblique, chin heavy and dilated; teeth in both jaws in 2 rows, the outer row long, pointed, slender, wide-set, and depressible, the inner row minute; dorsal fin with 6 to 10 simple rays. **Caragobioides**
1*b*. Pouchlike cavity over each opercle present (TRYPAUCHENINAE).
  4*a*. Ventral fins completely united into a funnel-shaped disk........ **Trypauchen**
  4*b*. Ventral fins separated to their base........ **Trypauchenichthys**

Subfamily TAENIOIDINAE

Genus TAENIOIDES Lacepède

Taenioides LACEPÈDE, Histoire naturelle des poissons, vol. 2, p. 532, 1800. (Type, *Taenioides hermannii* Lacepède.)

The genus *Taenioides*, with the haplotype *T. hermannii* Lacepède, not *T. hermannianus* as stated by Bleeker (1874 [453]), Jordan (1917, pt. 1, p. 57), and Koumans (1931), has four recorded local species and probably several more remain to be detected in the fresh waters of Thailand. The greatly elongate form might to the uninitiated give the impression that these fishes are eels. Their large mouth, formidable array of teeth, and bulldoglike lower jaw are combined with a vicious disposition.

The Thailand species are differentiated by the following characters:

1*a*. Dorsal and anal fins more or less completely united with caudal.
  2*a*. A pair of postsymphyseal canine teeth in lower jaw, about 16 large curved teeth in outer row of upper jaw, about 14 in lower jaw; scaleless; general color pink ---------- anguillaris
  2*b*. No postsymphyseal canine teeth in lower jaw.
    3*a*. Scaleless; depth of body 18.5 to 20 times in total length; about 10 large curved teeth in outer row of each jaw; general color olivaceous, fins darker ---------- gracilis
    3*b*. Posterior third of body covered with minute cycloid scales; depth of body about 14 times in total length; about 6 large curved teeth in outer row of upper jaw, about 8 in lower jaw; general color olivaceous, vertical fins black ---------- nigrimarginatus
1*b*. Dorsal and anal fins completely separated from caudal; no postsymphyseal canines in lower jaw; 8 to 10 large curved teeth in outer row of upper jaw, 6 to 8 in lower jaw; scaleless; general color bright pink or pale yellow, with a series of round brownish spots along side ---------- cirratus

TAENIOIDES ANGUILLARIS (Linnaeus)

Gobius anguillaris LINNAEUS, 1766, p. 450 (China).
Taenioides anguillaris FOWLER, 1935a, p. 163 (Bangkok, Paknam).
Taenioides angullaris FOWLER, 1937, p. 257 (Bangkok).

An eellike goby recorded from India, the Indo-Australian Archipelago, China, and elsewhere under the name *Taenioides anguillaris* may not with certainty be identified with *Gobius anguillaris* Linnaeus, the description of which is very brief and applicable to several Oriental species now referred to the genus *Taenioides*. The species herein considered is the one described and figured by Day (1876–78) as *Gobioides anguillaris* (Linnaeus) and characterized by features shown in the preceding key.

The species was first met with in Thailand in 1927, when the writer obtained several specimens from a pongpang net in the Menam Chao Phya near Bang Torani, between Bangkok and Ayuthia; the largest of these was 9.5 cm. long. Fowler (1935a and 1937) referred to seven specimens, 10.8 to 23.6 cm. long, taken in the Menam Chao Phya at Bangkok and Paknam.

TAENIOIDES GRACILIS (Cuvier and Valenciennes)

Amblyopus gracilis CUVIER and VALENCIENNES, 1837, vol. 12, p. 166 (Pondicherry).

This goby ranges from India to the East Indies and the Philippines. It is apparently rare in Thailand, and only a single definite record is available, a fish, 13.5 cm. long, taken in the Menam Chao Phya at Paknam in June 1927.

A length of 19 to 20 cm. is reported in other waters.

TAENIOIDES NIGRIMARGINATUS Hora

Taenioides nigrimarginatus HORA, 1924a, p. 496, fig. 8 (Singora).

Hora described this species from four specimens, the largest 16.5 and 23.1 cm. long, obtained by Dr. Annandale at Singora, in 1916. This is the only local member of the genus having scales (on posterior third of body). This feature, with the black vertical fins, makes the species easily identifiable.

TAENIOIDES CIRRATUS (Blyth)

Amblyopus cirratus BLYTH, 1860b, p. 147 (locality unknown "but probably obtained in the Calcutta bazaar").
Taenioides cirratus H. M. SMITH, 1931d, p. 189 (Meklong).

First made known by Blyth from the Hooghli River, India, this fish has been found to range through the East Indies to the Philippines. It was recorded from Thailand in 1931 and does not appear to have been reported there since. The unique specimen was taken in October 1929 in a canal off the Meklong and had a rather interesting history. The capture of an "electric fish" had been announced in a local newspaper and the creature was exhibited alive in Rajaburi, where it attracted considerable attention because of its reputed electric properties. It had been caught on a muddy bank by a woman using a line, and had been seen in a spirited fight with a snake (*Cylindrophis rufus*), which was subsequently found dead. The color in life was a pale yellow with a series of 21 small roundish yellowish brown spots extending along the side from under the first dorsal spine to the base of the caudal fin; the fins were of the same color as the body except the caudal, which was a yellowish brown with a blackish tip. Dorsal rays VI,I,45; anal rays I,39 to I,41. Length over all 38 cm., length to base of caudal fin 34.25 cm.; depth at origin of dorsal fin 2.2 cm. The greatest length recorded by Day for this fish in India is 25 cm., and by Herre in the Philippines is 18.2 cm. The Thai example may represent about the maximum size attained. It was impossible to obtain this fish for preservation, owing to the prohibitive price placed on it by the owner who, however, was willing to have it examined and handled with the cautionary information that it might impart a dangerous electric shock.

Genus BRACHYAMBLYOPUS Bleeker

Brachyamblyopus BLEEKER (453), Arch. Néerl. Sci. Nat., vol. 9, p. 329, 1874. (Type, *Amblyopus brachysoma* Bleeker.)

The introduction of the generic name *Brachyamblyopus* was made by Bleeker in 1874 as a substitute for *Amblyopus* of Cuvier and Valenciennes (1837), the latter name being a synonym for *Taenioides* of Lacepède (1800). The type of *Brachyamblyopus* is *Amblyopus brachysoma* Bleeker, which, with another Bleekerian species, is known from Thailand. The two species that occur in Thailand are:

1*a*. Body more or less covered with small, scattered, partly imbedded scales, larger posteriorly; head naked; anal rays I,27; pink........ brachysoma

1*b*. Body and head naked except for minute, scattered scales on posterior part of length; anal rays I,23; blood-red or greenish.................. urolepis

Günther (1861, vol. 3, p. 136) retained the name *Amblyopus* for fishes properly called *Taenioides* and *Gobioides* for the remarkable reasons that "it is generally used, and also because such names as Gobioides, Taenioides, etc., should always be avoided."

BRACHYAMBLYOPUS BRACHYSOMA (Bleeker)

Amblyopus brachysoma Bleeker, 1853 (86), p. 510 (Priaman, Sumatra).—von Martens, 1876, p. 393 (Bangkok).

The only record of this fish in Thailand is that given by von Martens, who listed it from fresh water in Bangkok. The species is otherwise known from Sumatra.

BRACHYAMBLYOPUS UROLEPIS (Bleeker)

Amblyopus urolepis Bleeker, 1852 (67), p. 581 (Palembang, Sumatra).

Described from rivers of Sumatra, this species was detected in Thailand during the years 1923, 1927, and 1928, in the Bangpakong and Chao Phya Rivers, and is probably not rare.

The various specimens collected were 6.8 to 8 cm. long, and were recorded as blood red when first taken.

CARAGOBIOIDES, new genus

The characters of the genus are those of the species set forth in the key on page 568, which also separates it from all related genera.

Genotype.—Caragobius geomys Fowler.

CARAGOBIOIDES GEOMYS (Fowler)

Caragobius geomys Fowler, 1935a, p. 161, figs. 129, 130 (Bangkok).

Known from eight specimens, 6.1 to 7.5 cm. long, taken in Bangkok in May and July 1934, this species seems separable from *Caragobius typhlops* Smith and Seale, the type of *Caragobius* from the Philippines, by its more tapering body, 10 simple dorsal rays (against 6), longer and more pointed caudal fin, and apparently uniserial teeth. The last feature, if confirmed, together with the increased number of simple dorsal rays, would, with other possible characters, probably justify a special genus for its accommodation; for this genus the name *Caragobioides* is suggested.

Subfamily TRYPAUCHENINAE

Genus TRYPAUCHEN Cuvier and Valenciennes

Trypauchen Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 12, p. 152, 1837. (Type, *Trypauchen vagina* Cuvier and Valenciennes.)

TRYPAUCHEN VAGINA (Bloch)

Gobius vagina Bloch, *in* Schneider, 1801, p. 73 (Tranquebar).
Trypauchen vagina Hora, 1924a, p. 497 (Tale Sap near Singora).—Fowler, 1934a, p. 161 (Bangkok) ; 1935a, p. 163 (Bangkok, Paknam) ; 1937, p. 257 (Tachin).

This is a fairly common fish from India to China, frequenting the coasts, estuaries, and lower course of coastal streams. It is essentially a salt-water form, but it sometimes pushes its way up rivers into water that is nearly or quite fresh. It is common up the Menam Chao Phya below Bangkok, and is known also from the Bangpakong River, the Chantabun River and its estuary, and from the outer lake of the Tale Sap. Its pinky white color and minute black eyes make it conspicuous.

A length of 20 to 22 inches is attained in local waters.

A vernacular name for the fish in the Chantabun district is *pla pluad*.

Genus TRYPAUCHENICHTHYS Bleeker

Trypauchenichthys Bleeker (272), Act. Soc. Sci. Indo.-Neerl. Borneo), vol. 8, p. 63, 1860. (Type, *Trypauchenichthys typus* Bleeker.)

TRYPAUCHENICHTHYS TYPUS Bleeker

Trypauchenichthys typus Bleeker, 1860 (272), p. 63 (Borneo).—Hora, 1924a, p. 497 (Tale Sap) ; 1924b, p. 155 (Tale Sap).—Herre, 1927, p. 340 (Tale Sap, after Hora).

This is apparently an uncommon species of Borneo and the Philippines, with a record of two specimens collected by Annandale in the Tale Sap and reported by Hora, the first and only citation for Thailand. It is a salt-water or brackish-water form.

A length in excess of 12.5 cm. is attained.

Order PLECTOGNATHI

Family TETRAODONTIDAE: Swellfishes, or Puffers

This very large family, mostly marine, is represented in Thailand by several genera having species that inhabit fresh water or more or less regularly seek the lower courses of streams.

By means of a cavity connected with the pharynx and provided with a valve, the fish is able to inflate itself enormously with air and then to float like a balloon.

In some species the muscular tissue and abdominal viscera are extremely poisonous, and in Thailand, as in other parts of the world, deaths have occurred when human beings have eaten such fishes. The poison, an alkaloid related to the deadly principle found in certain mushrooms, acts quickly and death may ensue in 1 to 3 hours.

Four genera are known to Thailand as follows:

1*a*. Each nostril with 2 openings in a short tube or papilla__________ Sphoeroides
1*b*. Each nostril with a simple imperforate cavity surrounded by a tube or provided with a tentacle.
  2*a*. Dorsal and anal fins long, with 25 to 36 rays and 22 to 29 rays respectively; coloration plain ____________________________________ Chonerhinus
  2*b*. Dorsal and anal fins short, with less than 15 rays; coloration various.
    3*a*. Each nostril with a short tube, whose margin is divided into flaps or fringe; back and abdomen spinous, middle of side smooth__ Chelonodon
    3*b*. Each nostril with a bifid tentacle; body more or less spinous__ Tetraodon

Genus SPHOEROIDES Anonymous

Sphoeroides (author anonymous), Allg. Lit. Zeit., 1798, col. 676. (Type, *Tetrodon spengleri* Bloch.)

SPHOEROIDES LUNARIS (Bloch)

Tetrodon lunaris Bloch, *in* Schneider, 1801, p. 505 (Sea of Malabarico).
Tetraodon lunaris Bleeker, 1865 (356), p. 172 (Siam).
Lagocephalus lunaris Fowler, 1937, p. 264 (Pitsanulok, Tachin, Paknam).

This widely distributed and common species of eastern and southern Asia, the Philippines, and the Indo-Australian Archipelago is essentially marine, but it enters the mouths of rivers and, exceptionally, appears to go far up streams. A noteworthy record for Thailand, where the species is abundant in the coastal waters, is for the Nan River at Pitsanulok (Fowler, 1937).

A length of 25 cm. is attained.

Genus CHONERHINUS Bleeker

Chonerhinus Bleeker (301), Atlas ichthyologique, vol. 5, p. 49, 1865. (Type, *Chonerhinus naritus* Bleeker=*Tetraodon naritus* Richardson.)

This genus is characterized by a well-compressed, rather stout body, many-rayed dorsal and anal fins, a single imperforate nostril on each side surrounded by a rather high rim, small spines on abdomen and sides, and plain coloration (golden yellow, golden green). The two local species, very similar, may be distinguished by the features indicated as follows:

1*a*. Abdominal spines not extending upward beyond the level of the pectoral fins; dorsal rays v, 20 or vi, 20; anal rays iii or iv, 19 or 20___________modestus
1*b*. Abdominal spines extending upward beyond pectorals both anteriorly and posteriorly; dorsal rays iv or v, 31 or 32; anal rays ii or iii, 26____ naritus

CHONERHINUS MODESTUS (Bleeker)

Tetraodon (*Arothron*) *modestus* BLEEKER, 1851 (26), p. 16 (Bandjermassing, Borneo).
Chonerhinus modestus HORA, 1923*b*, p. 183 (Nontaburi).

In the lower part of the Menam Chao Phya basin this fish of the rivers of Borneo, Sumatra, and Malaya is fairly common in some places and at certain times. Seven specimens collected at Bangkok, on December 17, 1925, were in spawning condition, the largest, a female 13 cm. long, having ripe eggs.

In life this species is of a beautiful golden yellow or golden greenish color.

The vernacular name *pla pak pao*, which is borne by the tetraodonts generally, in the case of this fish is modified into *pla pak pao tong* (*tong*, golden).

CHONERHINUS NARITUS (Richardson)

Tetraodon naritus RICHARDSON, 1848, p. 18, pl. 8, figs. 1–3 (Sarawak River, Borneo).
Chonerhinus naritus BLEEKER, 1865 (347), p. 33 (Siam); 1865 (356), p. 172 (Siam).

The only Thailand records for this species are those of Bleeker, based on a specimen or specimens in the Musée du Jardin des Plantes à Paris collected by Bocourt in 1861–62, probably in the Menam Chao Phya at Bangkok or Ayuthia. The fish inhabits the rivers of Sumatra and Borneo, and Bleeker notes the length of specimens therefrom as ranging from 6.4 to 28.5 cm.

Genus CHELONODON Müller

Chelonodon MÜLLER, Abh. Preuss. Akad. Wiss. Berlin, 1839, p. 252. (Type, *Tetrodon patoca* Hamilton.)

In this genus the body is cylindrical, the head very broad, the back and abdomen are covered with small spines leaving a smooth area along the side; the single shallow, imperforate nostril on each side is surrounded by a short tube margined with flaps or a fringe; dorsal and anal fins are short, with 6 to 9 branched rays.

CHELONODON PATOCA (Hamilton)

Tetrodon patoca HAMILTON, 1822, pp. 7, 362 (Ganges).
? *Chelonodon dumerili* BLEEKER, 1865 (347), p. 33 (Siam); 1865 (356), p. 172 (Siam).

This is a well-known species ranging from India to China, Malaya, and various islands of the East Indies, frequenting coastal waters and entering the lower courses of rivers. Two specimens of this species from Thailand in the British Museum were presented by Prince Chumporn. A single specimen, 7.5 cm. long, taken at Yamoo on a branch of the Patani River, Peninsular Thailand, October 12, 1927, is U.S.N.M. No. 109685. There seem to be no other Thai records.

The species *C. patoca* is characterized by having the dark back and top of head thickly covered with small round white spots, the lower parts silvery. Immature specimens, like the one from Yamoo, often show three or four dark cross bands extending from the back to the middle of the side.

A length of 30 cm. or somewhat more is attained.

Bleeker listed as *Chelonodon dumerili*, new species, a fish collected in Thailand by Bocourt, referring to it as "restent à décrire." In a second paper issued in the same year the fish appears as *Chelonodon dumerili* Bleeker without comment. No description of the species was ever published, there are no further references to it in the literature, and this name has no standing. It is suspected that the fish Bleeker had was *Chelonodon patoca.*

Genus TETRAODON Linnaeus

Tetraodon Linnaeus, Systema naturae, ed. 10, p. 332, 1758. (Type, *Tetraodon lineatus* Linnaeus.)

This genus of numerous marine and estuarine fishes has several representatives in Thailand as in other Oriental countries that occur in fresh water.

Compared with the marine species, the fresh-water forms are of small size.

The vernacular name of all these fishes in Thailand is *pla pak pao.*

In addition to the species given in the following key, there are several others, specimens of which have been noted as coming from the fresh waters of Thailand but which cannot be conclusively accepted as to identification. Among these are: (1) *Tetraodon hispidus* Linnaeus, a specimen 17 cm. long, March 2, 1924, from Chiengrai, on the Mekok, a tributary of the Mekong. This specimen, called *pla klom pak wong*, agreed well with the descriptions and figures of this well-known species, differing only in minor features. As Chiengrai is over a thousand miles from the sea and this species is not otherwise known from fresh water, the identification must be considered doubtful. The specimen is not available for further examination. (2) *Tetraodon immaculatus* Bloch, *in* Schneider. Four specimens 5.8 to 8.3 cm. long are reported by Fowler (1937) as coming from Kemarat, Eastern Thailand, several hundred miles up the Mekong. No description of the specimen is given except as to the flatness of the interorbital space; but the figure of a specimen 6 cm. long shows peculiar dark markings on head, back, and side such as are wholly unknown in the two color varieties of this species, *immaculatus* (unmarked) and *manillensis* (with 6 to 12 narrow dark longitudinal lines extending the entire length of the fish). As this form is otherwise unknown from fresh water, there is doubt as to the identification.

Three species, known definitely from Thailand, are set forth in the following diagnosis:

1*a*. Body and head covered with an irregular network of thin dark lines, some of the meshes enclosing black spots; dorsal fin arising far in advance of anal fin-- palembangensis

1*b*. Body and head more or less covered with dark spots, dorsal fin arising over or slightly in advance of origin of anal fin.

  2*a*. Entire head and body except middle of abdomen covered with small, round, crowded black spots larger posteriorly; some or all of the spots may have a narrow light edge; no cross bands on caudal fin--------- leiurus

  2*b*. Back, upper part of head, and side more or less thickly covered with large dark spots, mostly circular; about 6 narrow dark cross bars on caudal fin--- fluviatilis

TETRAODON PALEMBANGENSIS Bleeker

Tetraodon palembangensis BLEEKER, 1852 (62), p. 25 (Palembang, Sumatra).—HORA, 1923b, p. 183 (Nontaburi); 1924a, p. 499, fig. 9 (inner lake of Tale Sap).

Tetrodon palembangensis GÜNTHER, 1870, vol. 8, p. 288 (Siam).—KÁROLI, 1882, p. 187 (Siam).—FOWLER, 1934b, p. 351, fig. 13 (Krat); 1935a, p. 163 (Srisawat).

Tetraodon palenbengensis SAUVAGE, 1883b, p. 155 (Menam Chao Phya).

This is a strictly fresh-water species, found in the rivers of Borneo, Sumatra, and Thailand, and also in lakes in the Peninsula.

The British Museum contains a specimen collected in Thailand by Mouhot and noted in Günther's Catalogue. Other local records are indicated in the synonymy. Hora (1924a) reported five young specimens from the inner lake of the Tale Sap and figured two color phases that agree with young specimens referred to by Hora (1923b) from the Menam Chao Phya, collected by Dr. Malcolm Smith. An interesting specimen, taken in the Tale Noi, September 28, 1927, by Masya and Suvatti, of the Siamese Bureau of Fisheries, was 19 cm. long and exhibited large black meshes on a yellow background, some of the meshes enclosing black spots.

The fish is easily recognizable by the network of narrow blackish lines completely covering the head and body.

The name given to the fish by the local fishermen was *pla pak pao nam chuet* (*nam chuet*, fresh water).

TETRAODON LEIURUS Bleeker

Tetraodon leiurus Bleeker, 1852 (62), pp. 18, 22 (Batavia).
Arothron leiurus Bleeker, 1865 (347), p. 33 (Siam) ; 1865 (356), p. 172 (Siam)
Crayracion leiurus Bleeker, 1865 (301), vol. 5. p. 67 ("le Meinam," Central Siam)
Tetraodon liurus Hora, 1923b, p. 184 (Nontaburi).
Tetrodon leiurus Fowler 1934a, p. 161 (Chiengmai) ; 1937, p. 264, figs. 299, 30 (Pitsanulok).

This is a river species of Java, Borneo, Sumatra, and Thailand, an in Thailand it pushes its way far inland.

Bleeker (1865 [301]) recorded the fish from "the Menam, the grea river of Siam, where it was found by M.-de Castelnau," as the onl locality outside the archipelago from which he knew it. Fowler de scribed and figured a specimen, 8.1 cm. long, from the Menam Nan a Pitsanulok. The fish may be recognized by the characteristic of havin the entire head and body except the middle of the abdomen thickl covered with large and small round black or dark brown spots, som or all of which may have a narrow white edge.

A length of 13 cm. seems to be about the maximum attained in th East Indies.

It has been impossible for the present writer to identify wit *Tetraodon leiurus* the various specimens from the Menam Chao Phy and the Tale Sap that Hora (1923b, 1924a) assigned to this species an they may represent an undescribed species.

TETRAODON FLUVIATILIS Hamilton

Tetrodon fluviatilis Hamilton, 1822, p. 6, pl. 33, fig. 1 (lower parts of Bengal)
Tetraodon fluviatilis Sauvage, 1883b, p. 155 (Menam Chao Phya).
Dichotomycter fluviatilis Fowler, 1937, p. 264, fig. 297 Tachin).

Ranging along the coasts from India to the Philippines and regularly entering the large rivers and ascending them into water that i strictly fresh, this species does not appear to be at all common in Thailand, and there are only a few records from strictly fresh water.

It reaches a length of 15 cm. or a little more, and is usually marke by numerous round black or dark brown spots on head, back, and sides the greenish brown back may have greenish vermiculations; the bell is white or yellow; the caudal fin has numerous dark brown cross bands The degree of spinosity varies considerably, and examples are foun that are perfectly smooth, although normally there are spines on th head posterior to the eyes, on the abdomen, and on the back and side anterior to the dorsal and anal fins.

The fish is very poisonous to human beings and also to ducks and other domestic animals that eat the flesh or viscera.

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